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REPORT OF THE CONIFER CONFERENCE

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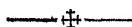
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CONTENTS.

PREFACE	v
SOME FEATURES OF INTEREST IN THE ORDER OF CONIFERS. By Dr. MAXWELL T. MASTERS, F.R.S., F.R.H.S.....	1
THE CONIFERÆ OF JAPAN. By Mr. H. J. VEITCH, F.L.S., F.R.H.S.	18
CONIFERS AS SPECIMEN TREES FOR LANDSCAPE GARDENING. By Mr. GEO. NICHOLSON, A.L.S., F.R.H.S.	34
CONIFERS FOR ECONOMIC PLANTING. By Mr. A. D. WEBSTER, F.R.S.E.....	41
THE DECORATIVE CHARACTER OF CONIFERS. By Mr. E. J. BAILLIE, F.L.S.	52
CONIFERS AT DROPMORE. By Mr. CHAS. HERRIN	61
CONIFERS AT ORTON LONGUEVILLE. By Mr. A. HARDING	67
OPENING ADDRESS (Second Day). By Mr. W. T. THISELTON DYER, C.M.G., F.R.S., &c.....	72
THE VALUE IN THE BRITISH ISLANDS OF INTRODUCED CONIFERS. By Mr. MALCOLM DUNN, F.R.H.S.	73
THE QUALITY OF CONIFEROUS TIMBER AS AFFECTED BY SYLVI- CULTURAL TREATMENT. By W. SOMERVILLE, D.Cec., B.Sc., &c.	103
THE TIMBER OF EXOTIC CONIFERS. By Mr. D. F. MACKENZIE...	115
DISEASES OF CONIFERS. By Prof. MARSHALL WARD, M.A., F.R.S., &c.	124
INSECTS INJURIOUS TO CONIFERÆ. By Mr. W. F. H. BLANDFORD, M.A., F.R.H.S., &c.....	150
LIST OF CONIFERS AND TAXADS CULTIVATED IN GREAT BRITAIN AND IRELAND. By Dr. MAXWELL T. MASTERS, F.R.S., F.R.H.S.	179
PINETUM DANICUM. By Prof. CARL HANSEN	257
STATISTICS OF CONIFERS IN THE COUNTIES OF ENGLAND, SCOT- LAND, AND IRELAND. By Mr. MALCOLM DUNN, F.R.H.S. ...	481
LIST OF LARGEST SPECIMENS IN THE UNITED KINGDOM	568
CONIFERS SUITABLE FOR VARIOUS PURPOSES	572
LIST OF EXHIBITORS AND AWARDS	575
LIST OF CONIFERS EXHIBITED AT THE CONFERENCE	579
INDEX	587

PREFACE.



IN sending out this memorial of the Conifer Conference, 1891, we would draw attention to the fact that it contains far more than a mere verbal report of the Conference, Dr. Maxwell T. Masters, F.R.S., and Professor Carl Hansen, of Copenhagen, having promised at the time to recast their notes more fully. This they have done most kindly and with infinite labour and research, but not without some little expenditure of time, the final sheets of MS. having only come into our hands in July, and the corrections extending up to the 29th of September.

Nomenclature.—The names adopted by Dr. Masters and Professor Hansen may, of course, be relied upon as representing the latest decisions of botanical science in England and on the Continent of Europe respectively, though future research may necessitate some still further slight alterations. However, the hitherto inextricably confused nomenclature of Conifers may safely be described as settling down upon the lines adopted in this volume by these two eminent authorities, who, although not yet in absolute agreement, will be found to approach very nearly. After most careful consideration we have thought it better to leave the names in the papers read at the Conference and in the List of Returns almost unchanged, for had we altered the various and varying names, erroneously used, into those scientifically correct, the writers would in many cases have hardly recognised the plants of which they were speaking. Having set forth a correct system of nomenclature for Great Britain in Dr. Masters' "Synopsis," we must refer all readers to it for verification of names occurring elsewhere in the volume, and leave it to time to bring about a slow and gradual reformation whereby the discarded names may become changed into

those scientifically correct. At the same time we would venture to urge all nurserymen and growers of Conifers to at once begin the substitution of the correct for the erroneous names, adding perhaps for some few years to come the now obsolete one in brackets, thus:—"Sequoia (Wellingtonia) gigantea," or "Tsuga Mertensiana (Abies Albertiana)." In proof of the great confusion and diversity of nomenclature, the reader has but to refer to the "List of Conifers Exhibited" (see page 579), where every specimen shown appears under both the name used by the exhibitor and that by which it should be more properly known.

The Index.—It has not been thought necessary to make the general index to the volume include the contributions of Dr. Masters and Professor Hansen, as they are themselves of the nature of indices. The reader referring to the General Index must therefore bear in mind that he will probably find the plant he is searching for mentioned in Dr. Masters' and Professor Hansen's lists as well as at the page indexed. To have indexed these lists would have been in great part to repeat them.

The Exhibitors.—The thanks of the Society are due to all the exhibitors for the profusion of specimens sent, which formed such a collection of coniferous plants as all experts agree had never before been collected in any one place. And herein we cannot help mentioning how greatly the Conference was indebted to Mr. Malcolm Dunn and the Scottish contingent.

Introducers.—The mention of thanks to the exhibitors cannot but remind one of the vast debt of gratitude which we of to-day owe to the intrepid men who have gone before us, and who for the most part introduced these beautiful plants; and no one can read the following pages without perceiving that it is to our Royal Horticultural Society that Great Britain in great measure owes both the first stimulus of introducing and the largest number of useful introductions. Douglas and Hartweg and Fortune, to whom the chief honours are due, were all sent out directly by the Society, and the rich harvest of their discoveries was distributed freely by the Society throughout the length and breadth of Great Britain. If our Society had no other record than this of the introduction of Conifers, it would still have deserved the cordial support of all who love our country woodland scenes and parks and copses.

JOURNAL

OF THE

ROYAL HORTICULTURAL SOCIETY.

VOL. XIV. 1892.

CONIFER CONFERENCE.

HELD AT CHISWICK, OCTOBER 7 AND 8, 1891.

OPENING ADDRESS ON "SOME FEATURES OF INTEREST IN THE ORDER OF CONIFERS."

By MAXWELL T. MASTERS, M.D., F.R.S., Corresponding
Member of the Institute of France.

ABOUT this time last year, in this very place, Mr. Shirley Hibberd, whose presence on occasions like this we so greatly miss, declared, in the emphatic manner characteristic of him, "that the Dahlia was the most wonderful of all flowers." Nobody gainsaid him. A short time afterwards, also in this place, under like circumstances, the same speaker asserted "that the Chrysanthemum was the most wonderful of all flowers!" Still nobody contradicted him.

In truth, all plants, all living creatures, are so wonderful that it is impossible to say which is the most so. Those which come under notice at the moment must therefore be admitted to have the greater claim to precedence.

) Permit me, in opening the business of this Conference, to advocate the pretensions of the Conifers, and if, in so doing, I travel in some particulars a little outside the bounds of practical horticulture, I do so of set purpose, in order to introduce variety

into our discussions, and also because practical matters will be treated of in these meetings by specialists of greater competence than myself.

It must suffice here to touch but lightly and superficially on some points of interest to all plant-lovers, and the few points selected must be taken as suggestive of the vast stores at the disposition of the earnest student rather than as in any way exhaustive.

ANTIQUITY.

And first as to antiquity. We may smile at the fable of a Montmorency swimming about in Noah's flood with the family pedigree held in his mouth for safety, but the story, at any rate, illustrates the respect we all more or less pay to a continuous record of unbroken descent. But the pedigrees constructed by genealogists and heralds are only as the records of seconds on the limitless dial of Time. I shall not attempt to sketch even the outlines of the geological history of Conifers, as it has been taught us by Williamson, Carruthers, Starkie Gardner, and many others.* It must suffice to say that the first traces of the order are met with in the Devonian and Carboniferous series—shall we say about half-way down the record of the earth's strata as we know it? but in any case so very long ago as to be utterly beyond computation.

But let us note particularly: The earliest Conifers of which geologists tell us were Araucarias. Pines followed not long after in the scale of geological time. Now these Araucarias and these Pines are about the most highly organised of the Conifers of the present day—and, so far as we can see, they were quite as highly organised then as they are now. Moreover, it is certain that many forms equally highly developed, or even more so, existed then, and in still earlier times, which have since disappeared. We must go still further back, then, for the origin of these Conifers. But how much further back? Who can tell? "Such knowledge is too wonderful for me. It is high—I cannot attain to it."

* The reader will find an admirable epitome of the history of the Gymnosperms in Mr. Starkie Gardner's "British Eocene Flora," published by the Paleontographical Society, in which the labours of British and Continental naturalists are summarised, and also in the learned and cautious "Fossil Botany" by Professor Count Solms-Laubach, of which an English translation has just issued from the Clarendon Press.

GENEALOGY.

But whilst it is utterly impossible to say when Conifers made their appearance on the surface of the globe, we have, nevertheless, some means of ascertaining with a high degree of probability what their lineage has been. All the available evidence goes to show that we must look for the ancestry of the Conifers among some group now extinct, but which must have been closely allied to existing Lycopods and Selaginellas. This presumption is based upon certain very remarkable peculiarities in the organs of fertilisation—in the pollen as well as in the ovule—originally observed in part by Robert Brown, and subsequently investigated in detail by Hofmeister, Strasburger, and many others. I cannot enter upon these points at any length, but I may put it thus: If, as is now proved, the construction of the innermost penetrals of the microspore and of the megaspore (of the pollen and of the seed, if I may so speak) be the same, if their method of working be substantially identical in the groups before mentioned, or if, to be more precise, the ovule of a Conifer contains a megaspore with a prothallus bearing archegonia, then the relationship between the Conifers and the higher Cryptogams must surely be considered to be established.

STAGES OF GROWTH.

There are other pieces of evidence which can be appreciated by any of us, even by those who are not trained microscopists, and they can be worked out better in the garden or in the forest than in the herbarium. They depend on the circumstance, which seems to be generally admitted, that the progressive changes which may be observed during the development and growth of each individual living creature are the reflections of similar changes and of similar stages of growth in their ancestry. Now the growth of Conifers presents a very close resemblance to that of Lycopods and Selaginellas. Of themselves these resemblances might be treated as merely superficial and unimportant, but when considered in association with those other embryonic "characters" that I have mentioned, it is impossible to resist the conclusion that we have to deal with "homologies"—that is, with real affinities, not with superficial or misleading resemblances.

An investigation of the various stages of growth of each species is not only of the greatest importance from a genealogical point of view, but it supplies the explanation to many a puzzling circumstance in their cultivation, and furnishes us with many hints which we may utilise in our daily practice. I would, therefore, strongly urge upon those who have leisure to devote to such investigation the comparative study of the living Conifers during the successive stages of their growth. They should not confine themselves to the investigation of any one species taken as a type, but they should examine comparatively, organ by organ, member by member, as many forms as they can obtain, and they should arrange and classify the results in due order, and with a due sense of proportion. In this manner the student should pass in review the whole life-history of the plants from the egg-stage to that of the "oospore" or ripe seed, and from the first formation of the embryo to the close of embryonic life—as represented in the process of germination, "the hatching of the chicken," and the complete development of such parts as were originally within the fertilised egg.

After germination comes an adolescent or transition stage, which is a particularly interesting one in Conifers. After the seed-leaves have been formed there are produced in very many, if not in all Conifers, leaves of a shape differing, on the one hand, from that of the seed-leaves, and, on the other, from that of the adult foliage. Such leaves are, of course, familiar to all who have had to do with the raising of Conifers. Again, look at the Junipers, especially such a one as *J. chinensis*, and you will see on the same branch two kinds of leaves, the one transitional and temporary, the other characteristic of the adult form.

The Retinosporas, so called, of our gardens have no separate existence as a genus, or even as species. They are mere stages in the growth of certain species of *Thuya*, of *Cupressus*, of *Chamaecyparis*, or of *Juniperus*. On the selfsame bush we find specimens of two or three different kinds of Retinospora, and we see others reverting to the adult form, and bearing the cones peculiar to it.

Of the adult stage I need say no more on this occasion than may serve to remind you that this is pre-eminently the stage in which the plant is adapted to reproduce itself, either by bud or by seed.

Thus we have the characteristics of the plant in the bud-stage and in the egg-stage to study ; and whilst the peculiarities of the latter are more specially the objects of study for the microscopist and the physiologist in the laboratory, the differences of the former (the bud-stage) are particularly fit for the observation of the horticulturist or the forester, and abound in practical lessons for his consideration. Some of the stages here alluded to more or less overlap one another, occur simultaneously, or are connected one with another by intermediate gradations, so that they cannot in all cases be sharply defined.

Now, as each individual plant passes, has passed, or may pass through any or all of these stages, so it must be that the species, which is only a collection of individuals, must have passed through the same stages. Some of the variations which puzzle us so much to-day, in all probability represent the conformation of the progenitors of existing plants ; at any rate there is ample evidence to show that Conifers in those remote times passed through the same stages as the existing ones do now, and that they were as well adapted to meet variable conditions as their descendants now are.

If, therefore, to repeat what has been said before, we find that the Conifers pass through the same stages, say, as the Selaginellas do, we naturally conclude that they have been derived from the same stock. Again, if we find that the Conifers pass through some of the stages visible in certain vascular Cryptogams, but not through others, we deem the relationship less close ; whilst if the phases of growth be almost wholly different, we naturally conclude that the relationship is proportionately remote.

I have mentioned these matters to show how botanists and geologists attack problems, with a reasonable chance of success, which on first consideration you might deem to be quite insoluble by mortal men—mere matters of speculation beyond the capability of actual demonstration.

PHYSIOLOGY, MOVEMENTS, &c.

I have so far endeavoured to show you how the geologist, the morphologist, the microscopist, the genealogist find rich mines for observation and research among the Conifers. The physiologists are none the less fortunate. You will have seen already

that this must be so; but I should like to add an illustration which presents itself every spring, and always excites increasing wonder. I allude to the remarkable growth-movements of the shoots, especially of the leader. During the period of rapid growth this may be observed particularly well in some species of *Abies* in which the shoot bends from the vertical nearly or quite to the horizontal, whilst its point is directed in the course of a few hours to each point of the compass in succession. Similarly the side-shoots are twisted as growth goes on. These are growth-movements such as Darwin watched so carefully in climbing plants and in root-tips, and which probably occur in some degree in all plants, but which one would hardly expect to see in so marked a degree in the stiff-looking shoots of the Conifers.

These movements depend upon the circumstance that the activity of growth and the fulness or turgescence of the cells of the shoot, which is a necessary accompaniment, are not equal in amount in all parts of the shoot at the same time, but are greater at one time in one part, at another time elsewhere. Another circumstance inducing these gyrations, which is frequently overlooked, is the amount of resistance offered by certain parts of the shoot itself. Thus the most active growth is at the base of the shoot (centrifugal). The apex of the shoot is occupied by cells which are smaller, and which are, moreover, checked in their growth by the compression exercised by the more or less tightly packed leaves and bud-scales which surround the tip of the shoot. The tip of the shoot then grows more slowly than the basal portions, and, acting as a check or curb, causes the shoot to twist just as we may conceive the radicles to do in consequence of the restrictions offered by the root-cap.

The movements of the leaves are of a different nature, and are very conspicuous in some species, as in *Abies Veitchii* and *Picea ajanensis*. By these movements the stomate-bearing surface—whether it be, as is usual, the lower, or, as it is by exception, the upper surface, as in Junipers and in *Picea ajanensis*—is exposed to the heat and light of the sun, and the evaporation of vapour is proportionately facilitated.

PRACTICAL ILLUSTRATIONS.

I do not advocate the comparative study of Conifers throughout all the stages of their growth for purely scientific reasons.

It is also because I believe the propagator and the planter may derive valuable hints from it that I venture to mention the subject to-day. Let me give you one or two illustrations. Many of you know the difficulty there is in obtaining a "leader" in some species—as in *Abies amabilis*, for instance—and this quite independently of any insect or fungus injury. On what circumstances does this difficulty depend, and how can we apply a remedy? A partial answer at least to these questions can be given after noticing the arrangement of the buds at the ends of the shoot. You will find in all cases a terminal bud at the end of the shoot and a circle of closely packed lateral buds immediately around it. Notice, too, how, in most species of *Pinus*, the terminal bud starts into growth in spring before the side ones do, and compare this state of things with what happens in *Abies* (Silver Firs), where the side-buds usually push first. There is an entire ring of these side-buds, and unless the central bud starts away first it will be pressed upon by its companions, its growth restricted, and its supplies of nourishment largely appropriated by its more vigorous companions. I have sometimes fancied that there is in some of the Silver Firs and in *Araucarias* an alternation of growth in different years, so that whilst in some seasons the terminal bud starts first, and manifests the greater amount of energy, in others the side-shoots are the first to move and the most vigorous in growth. But this is a matter which requires the observation over different years of a much larger series of specimens than I have been able to compass.

In any case, if what I have said be true, we have an easy means of securing a leader by simply suppressing the lateral buds.

I may also call your attention to the way in which the shoots of some species of *Pinus* are clothed to the base with leaves, whilst in others the base of the shoot is bare. The scraggy, unfurnished appearance of some old Pine-trees is accounted for by this peculiarity. What to suggest as a remedy in this case is not so easy. Nevertheless the frequent appearance of numerous adventitious shoots on the trunk of such species as *Pinus rigida*, *P. Sabiniana*, or *Sequoia sempervirens* seems to show that by a judicious disbudding or removal of the tips of some of the upper shoots forming the head a more bushy, or, as gardeners call it, a more furnished, habit would result.

The buds and the scales which envelop them afford valuable objects for study and comparison, the more so in that they are not so much influenced by external conditions as are some other organs, and that the "characters" they offer are therefore more constant than some others and proportionately well suited for the discrimination of one species from another. The manner in which the young growing shoots either push their way through the bud-scales, leaving them in the form of a tube or sheath, or lift them off in the form of a conical cap, is also a point worthy of attention, for, though not exempt from variation, it is sufficiently constant to be useful for purposes of discrimination. The form of the young shoot after it has protruded beyond the bud-scales also merits attention. Sometimes it is cylindric or conic, sometimes brush-like, at other times nearly flat, or with a central depression. These differences depend in the first instance upon the arrangement of the leaves in the bud, and in the next on the way in which they arrange themselves as the bud lengthens into the shoot.

The direction which the side-shoots assume when growing, independently of the gyratory movement before alluded to, is also worthy of notice. In some cases the most energetic growth is, at any rate for a time, on the lower surface of the shoot, whence arises an upward direction of the tip of the shoot and a curvature of the shoot itself, which is convex on the lower, concave on the upper surface. In other species the greatest growth-power is on the upper side of the shoot; the lower side now acting as a curb causes a downward bending of the tip of the shoot and a general curvature whose convexity is upwards. These are the conditions which botanists denote as "epinasty" and "hyponasty" respectively. Whether there is any definite relation between the "epinastic" condition and the downward bending of the so-called pendulous or weeping varieties of Spruce, of Sequoia, &c., is a matter for further inquiry and observation in the garden.

The branching of the Conifers is associated in most people's minds with the idea of formal symmetry, especially when the trees are young, and in some cases that remains true to the end; but, in most instances, wind and storm, frost and snow, and the innumerable contingencies that occur during the life of a tree leave their marks upon it, and the primitive regularity is replaced by a ruggedness of outline delightful to the eye of an artist,

interesting to the botanist, and one which unconsciously impresses the spectator, much in the same way that the human face, with its tale of trials surmounted, of cares ingrained, or of patient trust, arouses his interest and appeals to his sympathies.

Many of the "curiosities" among these plants are dependent upon the inordinate development of the branches in size or in number. Thus the curious "Snake Firs" (*Picea excelsa monstrosa*), with their long, lithe, unbranched arms trailing on the ground, owe their peculiar appearance to the circumstance that the side-buds are almost entirely suppressed or undeveloped. In such branches the leaves are often unusually large, as if to compensate for their diminished number and to ensure as large an amount of leaf-surface as if the branches were developed in the usual way.* The peculiar elegance and great diversity in the sprays of Cypressess and Thuyas is likewise due to variations in the direction and in the degree of branching of the ultimate twigs. A fascinating subject for investigation is here presented to the student, and one which would not only be useful to the scientific botanist, but specially advantageous to the propagator. Those who raise these plants from cuttings, say of a *Retinospora*, know well how important it is that the cutting should be taken from a leading and not from a lateral branch.

There are numerous other matters connected with the growth of these plants upon which gentlemen who have these trees under daily observation might give information. Is it a generally observed fact that the Eastern Arbor Vitæ (*Biota*) will not unite by grafting with the Western *Thuya occidentalis*; that the Golden Larch (*Pseudolarix Kämpferii*) will not graft on the common Larch, nor the Douglas on the Silver Fir; that *Abies Lowiana* (*Parsonsiana*) as a grafted plant is always unsatisfactory, whilst, on the other hand, that *Picea pungens* always does well when grafted on the Spruce? Again, is it generally known that *Thuyopsis borealis* must be propagated by cuttings rather than by seed, whilst the not distant *Thuya gigantea* (*Lobbii* of

* Since the Conference an obliging correspondent has informed me of an *Araucaria imbricata* which, after producing two tiers of branches, ceased to develop any side-branches, whilst the leader-shoot has continued to lengthen year after year. The analogy between the lithe branches of the *Araucaria* and those of the Snake Firs must often strike the observer.

gardens), like the *Wellingtonia*, does better when raised from seed than when propagated from cuttings?

Systematic information is also needed as to the hardiness and rate of growth of particular species on particular soils. Many such particulars are buried in the "*Pinetum Britannicum*" and in the horticultural journals; but it is time that they were made more accessible, and that the observations made some years since should be added to and correlated with the results of more recent inquiry, so that the records of this Congress may afford the most complete information on the growth of these trees in Britain.

BEAUTY OF FORM AND COLOUR.

Some will say they feel no interest in speculative chronology, internal structure, or mysterious laws of growth; they love beauty for its own sake. Be it so. They will find a rich harvest among the Conifers. The exhibition to-day furnishes abundant illustrations. Listen also to those who have traversed the forests of the Californian Sierras, and note how rapturously they speak of beauties which not even the Palms or Tree-Ferns of the tropics can excel—of majesty, of stature and dignity of form that the mountains only can surpass.

In point of colour we have every shade of green, from the tender green of the Swamp Cypress to the deep hues of the Cypress so expressively noted by Mrs. Trollope:

"And a cypress mystic-hearted
Cleaves the quiet dome of light,
With its black-green masses parted
But by gaps of blacker night."

In point, too, of colour, to say nothing of the many variegated and coloured forms so well represented to-day, the unfolding buds and shoots are marvels of beauty in the spring season, whilst the orange and crimson and purple of the male catkins, of the female flowers and of the young cones are not to be outdone in intensity of hue by any other plants whatever. Those who assert, as I have heard them assert, that Conifers are monotonous in point of colour can evidently never have seen the trees either when they put on their spring attire or when they don their mature bridal dress.

STATURE.

As to size, some of the Conifers are as veritable sons of Anak. Only some of the Eucalypts of Australia can approach them in this particular. We have Sequoias close upon 400 feet in height, *Pinus Lambertiana* and *ponderosa* not greatly inferior, whilst at the other extreme we have in New Zealand, as we learn from Professor Kirk, *Dacrydiums* smaller than our Polar Willow. What we have not got, and what geologists and explorers are on the look-out for, is an herbaceous Conifer or one which would link on to such a plant as *Isoetes*.

UTILITY.

Turning now to more utilitarian considerations, there is no need for me to remind you of the extreme importance of the Conifers. From the time we get up in the morning till we take our rest at night, from our cradles to our graves, we of the northern hemisphere at least, are daily availing ourselves in some way or another of the products of these trees. Without petroleum, tar, timber, or coal, where would our civilisation and prosperity be? To maintain an adequate supply of timber, to protect existing forests, renew old ones and plant new ones, is an urgent duty upon us as cultivators,* and one which will not be lost sight of in the proceedings of this Conference.

NOMENCLATURE.

Scientific nomenclature, of course, is subject to the vicissitudes of scientific progress, and thus changes occur which, though highly embarrassing to practical men, are historical landmarks to the botanist. The subject is not one which can be discussed at

* How urgent it is may be gathered from the following figures, taken from Dr. Schlich's "Manual of Forestry," vol. i., p. 58, *et seq.*:—Annual average value of imported wood, fifteen million pounds sterling, of which twelve millions represent the value of coniferous woods, oak, &c., which could be produced in this country, to say nothing of minor produce, such as bark, resin, &c. Dr. Schlich computes that 5,869,667 loads of timber are imported annually which could be grown in Britain. For the production of this amount six million acres of land, roughly speaking, would be required. Out of the total area of 26,757,000 acres of waste land in Britain, it may be assumed that at least six millions would be suitable for tree-culture. Large tracts in Ireland and the Hebrides now unproductive might be planted, and it is all the more desirable that this should be done as the prospects of a continuous importation of timber from Canada and Northern Europe, whence at present we derive our principal supplies, are by no means assured.

any length here, but I venture to counsel the general adoption by gardeners and foresters of the generic names as given in Bentham and Hooker's "Genera Plantarum," and, in the main, of the specific names as found in Veitch's "Manual," the more recent "Handbuch der Nadelholzkunde" of Beissner, or the catalogue published by the same author under the title of "Handbuch der Coniferen-Benennung." The want of an acquaintance with the German language forms no obstacle to the employment of this list, in which also are included the principal synonyms. As to the *Abies-Picea* question, concerning which so much has been written, I shall not attempt to add anything beyond the recommendation to our gardeners to adopt, for uniformity sake, the now all but universal plan of calling the Spruces "*Picea*" and the Silver Firs "*Abies*." This is the plan adopted by Bentham and Hooker and all modern writers on Conifers.

In dealing with specific names we are, I consider, bound by the spirit, if not always by the letter, of the "Lois de la Nomenclature Botanique" formulated by M. A. de Candolle, modified and adopted at the Paris Botanical Congress in 1867. According to the general spirit of this code we adopt as the proper name that which we believe to be correct both as to its generic and as to its specific portion. The two portions form one name. Either by itself is incomplete. Thus botanically we do not now speak of *Abies Douglasii* because Carrière's proposal to form a separate genus *Pseudotsuga* has been generally recognised as correct and is adopted in standard books. The plant, then, is now, for those who adopt the French botanist's ruling, *Pseudotsuga Douglasii* of Carrière. Any other names it may have had are relegated to the list of synonyms. But this practice does not commend itself to some of our Transatlantic friends, who consider that priority and precedence should be given, not necessarily to the generic half of the name, but to the specific half only. It so happens, for instance, that *Pseudotsuga Douglasii* was first made known as *Pinus taxifolia* of Lambert. Few botanists nowadays would include it under *Pinus*, so that the generic half of the name had to be changed. In changing it Carrière omitted to associate with his new generic name *Pseudotsuga* the old half-name *taxifolia*, but adopted in its stead the name *Douglasii*. Carrière was perfectly justified in

what he did, although it would have been better had he adopted the part-name *taxifolia*. Accordingly, as this last word is decidedly older in its application than is "Douglasii," Dr. Britton proposes to call the tree in future *Pseudotsuga taxifolia*, Britton. This plan we venture to think is objectionable and unfair to Carrière. Had the latter botanist been proved to be in error in his determination, it might have been right to have rejected his name; but as Carrière was quite within his rights in framing the name *Pseudotsuga Douglasii*, and no one proposes to alter the generic name he adopted, it seems unfair to deprive him of his rights as a nomenclator. The new-old name is further open to objection inasmuch as, by implication at least, it leads the reader to assume that Dr. Britton has in some way or another contributed to our scientific knowledge of the tree. This, indeed, may be so, but so far as we know his only title is that of unearthing a partial and incomplete appellation that once it might have been better to have adopted, but which, under the circumstances, may now be more advantageously forgotten, or at best consigned to the list of synonyms. Where no important principle and no injustice are involved we may be excused for following established custom and the law of convenience rather than inelastic convention.

Whilst the botanists are settling these points we may as horticulturists, without impropriety and with much convenience, continue to employ the name of the "Douglas Fir." There are occasionally times and circumstances, and this is such a case, when it is best to employ a "popular" name, although in most instances such epithets are unmitigated nuisances, if not worse.

INTRODUCTION OF SPECIES INTO CULTIVATION.

In this connection I may be permitted to remind you that, with the exception of the Scotch Pine, the Yew, and the Juniper, no species of Conifer is wild in Great Britain, and that in consequence we are, and always have been, largely dependent on foreign supplies. Our earliest records referring to the introduction of these plants do not go beyond the sixteenth century. We know that the Norway Spruce, the Cypress which grew in Gerard's garden, and was, as he asserts, "well known to most," the Arbor Vitæ, the Silver Fir, and the Stone Pine were in cultivation prior to 1548, and had probably been introduced much earlier.

The Pinaster was known here in 1596, the Larch in 1629, the Lebanon Cedar in 1664, shortly before the time of the great fire in London. It would be tedious to enumerate the dates of introduction of even the most remarkable only of the Pines and Firs, but in an assembly like this we ought gratefully to recall the services of Bishop Compton, by whose agency the Balsam Fir and various Atlantic-American species were introduced, and of John Evelyn, always a most honoured name in horticulture, who is credited with the introduction of the so-called Red Cedar (*Juniperus virginiana*). The Corsican Pine is said to have made its way hither in 1759, through whose instrumentality we do not know. In 1796 *Araucaria imbricata* was introduced from Chili by Menzies. The only survivor of that introduction is still at Kew in the shape of a decrepit veteran.

From 1827 to 1833, or thereabouts, Douglas startled the botanical and horticultural world by the number and importance of his discoveries in North-west America. The Douglas Fir, the Lambert Pine, the Menzies Spruce, *Abies amabilis*, *A. grandis*, *A. nobilis*, and many others may be mentioned as having been either discovered or introduced into this country by Douglas. To Fellows of the Royal Horticultural Society it must always be a source of legitimate pride that these magnificent and important discoveries (like those of Hartweg and Fortune later on) were made by officers of this Society, and that the plants were in the first instance grown and distributed from these very gardens of Chiswick. Amid the many memories which cling to Chiswick, amid the recollections of the many vicissitudes which have befallen our old Society, we may ever proudly remember the part that it has played in the introduction of these noble plants. Surely it is incumbent upon us to venerate the memory of the collectors who conferred so much honour on our Society and so much benefit on mankind.*

About the same time that Douglas was sending home the first instalment of these treasures, the Deodar was introduced from the Himalayas, and the Atlas Cedar appeared shortly afterwards. The useful Austrian Pine was introduced in 1835 from South-east Europe. In the next decade Hartweg introduced numerous

* The Lindley Library, however, contains no portrait of Douglas, of Fortune, or of Hartweg! Contrast this with the recent erection of a statue to Roezl at Prague.

species, including the Redwood (*Sequoia sempervirens*). These also were sent to Chiswick, grown and described by George Gordon, whose name will always be associated honourably with these plants, whatever view his successors may take of his work in detail. In 1846, and the subsequent years, Robert Fortune, whose name, like that of Douglas, should be inscribed in the golden book of the Society, introduced the *Cryptomeria japonica* and various highly curious species from China and Japan, to which I can only allude in passing.

In 1850 William Lobb, by the discovery and introduction through Messrs. Veitch of the Wellingtonia (*Sequoia gigantea*), renewed the excitement and astonishment which his predecessor Douglas had occasioned. There is no need for me here to do more than allude in passing to the marvels attaching to the Mammoth Tree and its near ally, the Redwood; but I may point out that, wonderful as they are in history and stature, they are surpassed in practical utility by another of William Lobb's introductions—I mean the Lobb's Thuya (*Thuya gigantea*).

In 1853 Thomas Lobb introduced from Java a single specimen of the very extraordinary Umbrella Pine (*Sciadopitys verticillata*), but it was not till 1861 that it was introduced in quantity by John Veitch and by Fortune. In the same year our Scottish friends sent out Jeffrey to Oregon, and to him we are indebted, amongst others, for the introduction of the magnificent *Libocedrus decurrens*. In the following year William Murray made known the very valuable Lawson's Cypress, or Port Orford Cedar. This was described by his brother Andrew Murray, at one time the secretary of our Society, and one whose knowledge of these plants was only equalled by his quaint humour and genial kindness. In or about 1860 the late John Gould Veitch was sending us from Japan several most beautiful and promising species, many of which were described by Andrew Murray in his "Pines and Firs of Japan," originally published in the Journal of our Society. Veitch's labours were supplemented nearly twenty years later by those of Charles Maries. The history of the introductions made by these two botanists, is it not written in the excellent "Manual of the Coniferæ" published by Messrs. Veitch?

I must needs curtail my remarks on the introduction of these plants, but before quitting the subject it may be interesting to

note that in introducing the *Araucarias* from Chili and Australia, the *Sequoias* and *Libocedrus* from the North-west Pacific, or the nearly allied *Cycads* from South Africa and Australia, we are but bringing back plants which flourished at various epochs upon our own soil. I do not know anything more wonderful from this point of view than the history of the genus *Ginkgo*, species of which once overspread the whole of the temperate and warmer regions of the globe, and one of which, the Maidenhair tree, known to us as wild only in China and as a cultivated plant, cannot be distinguished from the fossil plants. It is, in fact, a survivor from those extremely remote times of which mention has been made.* If in the course of our rambles we were to meet a living *Icthyosaurus*,† or any other uncanny monster, such as those whose models are placed in the grounds of the Crystal Palace, we should probably be not a little startled. And yet in the *Ginkgo* of China, the *Araucaria Cunninghamii* of North Australia, the *Libocedrus decurrens* of North-west America, the Servian Spruce (*Picea Omorika*), and even the Redwood of California, we have actually living in our gardens trees indistinguishable from those, some of which must have existed on the soil of our own land, such as it then was, ages before the gigantic Saurians before mentioned.

ECONOMIC VALUE.

But it is our business to study the prospects as well as the past history of these trees, and I venture to hope that one result of the present Conference will be the accumulation of evidence concerning the economic value of these introductions, especially of some of the more recent ones. We all know the value, as a decorative tree, of the Lebanon Cedar, one of the earliest of introductions of this kind, and we have had opportunity of testing the value of the Weymouth Pine. But with regard to many others we are still in doubt. Has not the Deodar, for instance, which was introduced with such great hopes, rather disappointed our expectations? Is the Douglas Fir likely to be of any great value as a timber tree?† Will either of them equal the Corsican Pine or the Menzies Spruce, which were introduced at an earlier

* Its powers of endurance are further curiously illustrated by the fact that this tree tolerates the smoky atmosphere of towns as well, if not better, than most others.

† See Dr. Schlich's remarks on the Earl of Mansfield's plantation of Douglas Firs in *Gardeners' Chronicle*, Nov. 10, 1888, pp. 533, 563, and 593

period? Again, considering the distressing failure of the Larch in many situations owing to the attacks of a fungus, carefully studied of late by Mr. John Carruthers, what have we among the new-comers that we may fairly look forward to with confidence as substitutes for it? I venture to think we have several, and I would hope that some of those present may favour us with their opinion on the prospects of such trees as *e.g.* Lobb's noble Cypress (*Thuya gigantea*), the Lawson Cypress, the Redwood (*Taxodium sempervirens*), the Nootka Cypress (*Thuyopsis borealis*), the *Abies brachyphylla*, and some others of Japanese origin. At one time I should have been disposed to have included the stately Nordmann Fir (*Abies Nordmanniana*), but, alas! it falls too ready a prey to the attack of a woolly aphid allied to that which, under the name of American blight, attacks our Apple-trees. In any case, it is to be feared that many of the Conifers, so handsome in their youth, are too precocious in this climate, and attain their full span of life much sooner than in their native country. Many of the Pines especially are already showing signs of decrepitude, which render them unsightly and sadly interfere with their value as timber trees.

Did time and space permit, I would fain say something more about the botanists by whose patient labour and piecing together of imperfect and discontinuous evidence the confusion that once reigned is becoming gradually cleared and the nomenclature more settled. The Mexican species are still imperfectly known, but the Californian and Japanese species are now much better defined than formerly, whilst, thanks in a great degree to Dr. Henry, much of the mystery investing the Chinese species has been dissipated, and Henry and the Abbés Delavay and David have enabled us to clear up the history of certain very interesting species previously only known as coming from Chinese gardens, and the structure and affinities of which were previously imperfectly known.

Such are "some of the features of interest" connected with this family. I might have dwelt on them at much greater length, I might have introduced a much larger number and a greater variety of illustrations, but there are limits even to your patience, and I must no longer interpose between you and the gentlemen who have undertaken to address you.

I shall have failed if I do not leave with you the impression

that, as was stated in the beginning, we have to deal with a most wonderful group of plants—one the importance of which to mankind is hardly second to any other; one with few or any superiors in interest, beauty, majesty or stature; one which supplies numerous links in the evolutionary chain connecting our present times with those periods when the foundations of the globe were laid; one which has had its share in making the world what it was in the past, and what it is in the present, whilst, so far as we are permitted to see, its influence will be no less potent in the future.

THE CONIFERÆ OF JAPAN.

By MR. HARRY J. VEITCH, F.L.S., F.R.H.S.

IN the programme of to-day's proceedings, the Council of the Royal Horticultural Society have assigned to me the subject of "Japanese, Chinese, and Californian Conifers," which covers a wide field for discussion, so wide indeed that, extending over two of the richest coniferous regions of the world, abundant subject-matter can easily be found for a separate paper on each. To attempt, therefore, to bring under review within a limited time so many objects of interest that have originated in the countries named, must necessarily result in a very imperfect rendering of the task assigned; for this reason I have preferred to confine my remarks to the Conifers of Japan. Moreover, I have an especial interest in these Conifers from the circumstance that the greater number of them were introduced to British gardens by our firm, through my brother, the late John Gould Veitch; all the introduced species and varieties have been since cultivated at our Coombe Wood Nursery, and have thence been long under direct observation.

With the view of bringing the subject before you in a connected form, I propose first to sketch the history of the discovery of the Japanese Conifers, then to compare the geographical positions and climates of Japan and Great Britain, and lastly to pass in review the species and varieties according to their tribes as seen in Japan and as we see them in Great Britain, noting instances where, and the conditions under which, they are found to thrive satisfactorily in our country.

The first glimpse of the magnificent vegetation of Japan obtained by a European naturalist was afforded to Kämpfer in the 17th century, but the record he left of it was too meagre to excite in those early days any interest respecting it. Nearly a hundred years elapsed before another European naturalist, the Swedish botanist Thunberg, landed in Japan. He stayed at Jeddo for about two months, and while there and at Nagasaki collected such materials as were within his reach, from which he afterwards compiled his "Flora japonica." Nine Conifers are included in this "Flora," of which five belong to the Fir and Pine tribe, and to which he gave the names of the European and American species they most resemble; three he referred to *Taxus*, of which *T. nucifera* and *T. macrophylla* are now brought under *Torreya* and *Podocarpus* respectively. The ninth, which he also mistook for a member of the Yew tribe, is the remarkable *Sciadopitys verticillata*. This was all that was practically known of Japanese Conifers till the Austrian physician Siebold entered the Dutch service nearly half a century later, and proceeded to Japan, where he resided several years. The publication of Siebold's "Flora" in 1842 was the first reliable intimation of the wealth of subjects that awaited introduction from that remote quarter of the globe; the figures and descriptions are carefully executed and drawn up, but they are those of cultivated plants only. Forty plates are devoted to coniferous trees and shrubs, but several of the species figured are not indigenous to Japan; and as the author had to draw his materials from native sources, it has, unfortunately, happened that, owing to the Japanese practice of applying the same name to two or more closely allied species, Siebold has, in one instance at least, mixed up two species under one name. A similar case happened to my brother, to which I shall have occasion to refer presently. It should here be noted that Thunberg during his stay in Japan was not permitted to leave the coast, and that Siebold during his long residence could not go beyond the limits assigned to him at Tokio (Jeddo) without special permission, and accompanied by a military escort. The botanical literature treating of Japanese Conifers during the twenty years following the publication of Siebold's "Flora" contains little else than transcriptions from that work.

The opening up of Japan in 1859 to European intercourse,

and the appointment of Sir Rutherford Alcock as British Minister, was an opportunity not to be neglected, and accordingly my brother, John Gould, proceeded to the East in the spring of 1860, and before returning home in the following year succeeded in discovering three *Abies* not previously known to science, two of which he introduced, in addition to all the indigenous Conifers known to Siebold, of which two, *Pinus densiflora* and *P. Thunbergii*, had previously found their way to Europe, probably through Siebold's agency. The *Cryptomeria* had been introduced from China by Fortune several years before, and *Podocarpus macrophylla* had also been brought from that country in the early part of the century. Fortune introduced *Thuya Standishii* (properly *T. japonica*) in the same year that my brother returned; about ten years later seeds of *Abies brachyphylla* were distributed from the Botanic Garden at St. Petersburg, the seedlings afterwards receiving in addition the names of *Veitchii* and *Harryana*. The latest acquisitions were made by Maries, who, while collecting for our firm in Japan, 1877-79, discovered the very distinct Fir that bears his name; he also sent to us the true *Abies Veitchii*, which John Gould Veitch had discovered but failed to procure seeds of, and *A. sachalinensis*, a northern tree with small cones like those of *A. Veitchii*, and with foliage resembling that of *A. sibirica*. The extensive knowledge of Japanese Conifers acquired by Maries in their native country enabled us to give in our Manual much interesting information respecting them not previously known; and the excellent materials brought home by him, which were placed in the hands of Dr. Masters for determination, led to the publication of a most valuable paper by our learned friend in the *Journal of the Linnean Society* (vol. xviii., p. 473). This paper contains the most complete enumeration of Japanese Conifers yet compiled, and I therefore gladly follow it for our present purpose. The latest contribution to our knowledge of these trees comes from Dr. Mayr, Professor of Forestry at Tokio (Jeddo), who, by a systematic arrangement of a large series of observations of the trees *in situ*, has put us in possession of an array of facts sufficient to allow of a tolerably just estimate to be formed of them as seen in their native country.

Dr. Masters says: "The Conifers recorded as natives of Japan admit of being grouped in thirteen genera, of which one only is

peculiar to that country, viz., *Sciadopitys*. The thirteen genera comprise forty-one species exclusive of varieties and doubtful natives, distributed thus:—The Silver Firs (*Abies*) have four endemic species in Japan, and two others common to Japan and North-east Asia; of *Picea* (the Spruce Firs) there are five species, three of which are peculiar to Japan; and of *Tsuga* (the Hemlock Spruce) there are two species. *Larix* has one species peculiar to Japan; *Pinus* has five species, but none of them endemic. *Thuja* (including *Thuyopsis*, *Biota*, and *Retinospora*) has four species peculiar to Japan, including *T. japonica* or *Standishii*, and one common to Japan and China; *Juniperus* is represented by five species, of which two are common to Japan and China. *Cryptomeria* also occurs both in Japan and China. *Cephalotaxus* is represented by three species; one Yew is peculiar to Japan, another is common to that country and China; *Torreya* has one species, and *Podocarpus* four. It may therefore be said that there are forty-one species of Conifers in Japan, of which no fewer than twenty-two are endemic." Up to the time of the publication of Siebold's "Flora" scarcely half a dozen of the endemic species were accurately known to science; thirty years ago only three of them were known in British gardens; at the present time, with the exception of two or three northern species unsuited to our climate, we have them all in our midst, both those peculiar to Japan and those common to that and other countries, some thriving better than others, but by far the greater number sufficiently acclimatised and playing a conspicuous rôle in the decoration of our gardens and parks.

This enumeration reveals the startling fact that, in proportion to the area of the country, the Flora of Japan includes more coniferous species than that of any other country in the world, and enormously in excess of the same element in the Flora of Great Britain, which includes only three indigenous species, the Scotch Fir, the common Juniper, and the Yew; yet the geographical position of the two groups of islands, Japanese and British, the one lying on the eastern and the other on the western side of the great Euro-Asiatic continent, although not similar are somewhat analogous, for while our group lies between the 50th and 60th parallels of north latitude, the Japanese group lies between the 30th and 45th parallels, that is to say, from 15 to 20 degrees nearer the equator than we are.

Notwithstanding the much greater proximity of the Japan islands to the equator, there is much similarity in the climatic conditions of the two groups, especially between those of England and Nippon, or Honda, the climate of the North of Scotland approaching more nearly that of Southern Yesso. Thus the isothermal line for 50° Fahrenheit which passes through Ireland and England between the 50th and 55th parallels curves below the 45th where it passes through Japan, which is the same as saying that the average yearly temperature of the two countries where that line passes, and to a certain distance on each side of it, is the same; but there the similarity ends. Turning to the other important factor in climatology, rainfall and atmospheric humidity, we find a great disparity between the two. The annual rainfall in the south-eastern counties of England rarely exceeds 25 inches, in the southern and western counties there is sometimes registered from 30 to 35 inches, in parts of Devonshire and Cornwall as much as 50 to 60 inches, and in particular localities, but of limited area, in Ireland, Wales, Cumberland, and the extreme south-west of Scotland it is even greater, but these cases must be regarded as exceptional ones due to local causes; on the other hand the annual rainfall in the eastern and midland counties ranges from 20 to 22 inches. In Jeddo the registered annual rainfall is 70 inches, with a gradual decrease northwards towards Yesso, where, in the absence of meteorological stations, it is estimated to be not much greater than in the midland counties of England; southwards from Jeddo the rainfall in each year seldom sinks below 50 inches. As the Gulf Stream exercises a great influence on the hygrometric condition of our atmosphere, so there is an analogous agency at work in Japan, which has a still greater influence on its climate; this is the north equatorial current of the great Pacific Ocean. This current flows westward parallel with the northern tropic till it reaches the island of Formosa, near the coast of China; it thence turns northward, when it becomes known as the Japan current, washes the southern shores of Kiusiu and Sikok, the southernmost of the Japanese islands, where its influence on the temperature and moisture of the climate is so great that such tropical Orchidæ as *Dendrobium*, *Aërides*, *Angræcum*, and *Calanthe* are indigenous. Continuing its course along the eastern shore of Nippon, the atmospheric humidity of Central Japan, through its means, Dr.

Mayr estimates to be fully 10 per cent. greater than in Western Europe. We have here a clue to the presence of a luxuriant coniferous vegetation on the range of mountains stretching through Nippon, culminating in the peak of Fusi-yama, which rises to 17,000 feet, and is covered with coniferous forest above the limits of the Oaks and Chestnuts, up to nearly the snow-line, the upper limit being occupied by *Larix leptolepis*.

At the risk of being tedious, I have brought before you these elementary geographical facts; but, simple as they are, they have a most important bearing on the distribution of coniferous vegetation, for we may learn from them that a high degree of humidity in the atmosphere is an all-important factor in the development of these gigantic coniferous trees. This phenomenon is present wherever gigantic coniferous trees exist. The enormous *Cryptomerias* of Japan, the grand Deodars of the Himalayas, the mammoth Sequoias of California, and the towering Firs of Oregon all owe their lofty proportions more to this than to any other cause. That the soil in which these trees grow is but a subordinate factor is shown by many examples. *Pinus densiflora* grows upon slopes of almost bare rock; William Lobb found *Abies bracteata* on the slaty debris of the Santa Lucia, where it would seem impossible for any vegetation to exist, and other instances could be adduced. We thence infer that when these and all other Conifers growing under the same conditions are planted in countries like England, for example, where the amount of atmospheric humidity is less, the moisture of a retentive soil, although favourable to coniferous growth, cannot of itself, in a drier atmosphere, fully compensate the hygrometric deficiency, and, carrying our inference a step further, we arrive at the conclusion that the gigantic Conifers I have named will never in this country attain the enormous dimensions reached by them in their native homes.

The southern islands of Japan have a sub-tropical climate, and nearly all the native Conifers belong to a sub-tropical genus, *Podocarpus*. The other Conifers met with in Southern Japan are believed to be cultivated plants brought from the central provinces, or introduced from China. On the other hand, the northern islands, Yesso, Sachalien, and the Kurile group, are subjected to the rigours of an almost Siberian winter; the period of active vegetation is restricted to four or five months. These

islands are but sparsely inhabited; they are for the most part covered with coniferous forests of the Siberian type, composed very largely of trees of the Fir and Pine tribe, and include *A. sachalinensis*, *A. jezoensis* of Siebold (the *A. microsperma* of Lindley), *A. Glehnii*; a Pine resembling a stunted *Pinus Cembra*, which Mayr calls *P. pumila*; and also a Larch, to which Mayr has given the name of *Larix kurilensis*. The first two have been introduced by our firm, but the mildness of our winters compared with that of their natural home stimulates them into premature growth, which is destroyed by spring frosts—an injury from which they but imperfectly recover, and hence they are practically useless for the British Arboretum; we will, therefore, dismiss them with the suggestion that they might be tried in the North of Scotland.

With these exceptions, all the Japanese Conifers cultivated in Great Britain have been brought from the principal island, Nippon, or Honda as it is sometimes called, and from that portion of it that lies between the 35th and 40th parallels, where the climate is intermediate between the extremes just mentioned, and in the highest degree favourable for their development. But here it should be noted that within this tract, owing to the presence of a dense population, comparatively little is left of the original vegetation; it is only to be seen here and there in the neighbourhood of shrines and temples, on inaccessible hanging rocks, on the steep places on the mountain-sides unsuited for cultivation, and on the summits of the mountain ranges.

We are now prepared to pass in review the Conifers of Nippon in the order of their tribes, commencing with the Firs and Pines.

Abies firma.—This is the common Silver Fir of Japan. It is spread generally, either wild or cultivated, over the southern half of Nippon. It also ascends to a considerable height on the central range, a circumstance that seems to affect its hardiness in this country; for, while some seedlings are killed outright by a severe winter, others escape unscathed, and this may have resulted from the situation of the trees from which the cones were gathered. It sometimes attains a great size; trunks 150 feet high and 4 feet in diameter have been measured. In its young state it is a fast-growing, symmetrical tree, remarkable for the variability of its foliage, which has caused it to be encumbered with many synonyms. In this country it is not so often seen as could

be wished; the handsomest specimens known to me are at Pencarrow in Cornwall, and at High Canons near Barnet, where, in the midst of many fine Conifers, it proclaims its individuality so decidedly as to suggest its more general use as an ornamental tree.

Abies homolepis or *brachyphylla*, for it is now clear that the trees to which these names have been applied belong to one and the same species. This is a later introduction than *A. firma*, and no large specimens yet exist in this country; but all that have come under observation, and these have been planted in many different soils, attest its suitability to our climate, and as an ornamental tree for the park and pleasure-ground it is unquestionably destined to take a high rank. In Japan it often attains a height of 125 feet. The silvery whiteness of the underside of its leaves becomes more intense and striking with the age of the tree.

Abies Veitchii is an alpine tree ascending to 6,000 feet and upwards, in places forming unmixed belts of considerable extent; in its lower limit sometimes mixed with *A. Tsuga* and *A. polita*. It is the most rapid grower of the Japanese *Abies*, and forms a slender tree upwards of 100 feet high, with rather short branches more distantly placed than in many other Firs. Plants eight to ten years established in this country are now showing a decided upward tendency. We may, therefore, expect this *Abies* to form a spirelike tree of light and open aspect. Its foliage is handsome, and may be compared with that of *A. amabilis* and *A. Nordmanniana*, between which it is intermediate in colour, but the leaves are far more silvery beneath than either.

Abies Mariesii is the smallest of the Japanese Silver Firs, and in some respects the most remarkable of them. Its geographical position is between *A. Veitchii* and *A. sachalinensis*, to either of which it bears but a slight resemblance. Its principal station is at Awamori, in Northern Nippon; it also occurs sparingly on the Nikko hills. Its cone declares it to be a true *Abies*, but its foliage resembles that of a *Tsuga* or Hemlock Fir. Being the latest introduction among the Japanese *Abies*, its ornamental qualities are not yet developed; its hardiness is, however, assured, both from its geographical position and from the experience of last winter (1890-91).

The Spruce Firs are next in interest. These are now often

called Piceas; and, although I purposely refrain as much as possible from introducing purely botanical questions into this paper, such is the unfortunate state of the nomenclature of some of these Firs and of other Japanese Conifers in its relation to horticulture, that occasional reference to it cannot be avoided. The names here used are those by which they are best known.*

Abies polita usually occurs mixed with other trees, and in favourable situations attains a height of upwards of 100 feet, but its timber is reported to be of but little value. Mayr observes that it is the stateliest of the Japanese Spruces, and commences its season's growth later. Our experience of it in England agrees with this; its growth is slow in its early life, but when established it is one of the most distinct and ornamental of its race, perfectly hardy, and thriving in many varieties of soil. Evidence of this is seen in the fine specimens growing at Linton, Tortworth, Pencarrow, Carclew, Warham Court, and other places, some of them now 20 feet high.

Abies ajanensis.—This was discovered by John G. Veitch while ascending Fusi-yama in company with Sir Rutherford Alcock. It grows in the cooler region of the mountain, associated with another Spruce Fir, to which the Japanese at that time applied the same name. Seeds of the two species were unwittingly mixed together, and seedlings of both were distributed under the name of *Abies Alcockiana*. Several years elapsed before the confusion became sufficiently apparent to call for correction, and the matter was at length referred to Dr. Masters, who retained one species under Lindley's original name *Alcockiana*, and referred the other to the *A. ajanensis* of Fischer. This was a satisfactory solution of the difficulty for the time; but, unfortunately, doubts have been raised since as to the accuracy of the identification, for Fischer's *ajanensis* is a northern tree inhabiting Yesso and Sachalien, where it is often mixed with *Abies sachalinensis*, but our *ajanensis*, according to Mayr, is not found north of the 38th parallel. This is perplexing enough, and will have to be dealt with in due course; for the present let us turn to the practical side of the question. In *A. ajanensis* (Masters) we have a useful ornamental tree, of sturdy growth, not capricious as to soil and situation, remarkably distinct in the

* For the correct botanical nomenclature of Conifers and Taxads, see Dr. Masters's "Synopsis," page 179 *et seq.*

colour of its young cones, which are produced very freely, even in the early age of the tree, and in the silvery whiteness of the underside of its leaves, surpassing in this respect every other Spruce Fir.

Abies Alcockiana—or perhaps it will be more correct to say the tree at present known under this name—is evidently not destined to receive so great an amount of favour among planters as the preceding species. It has also a formidable competitor in the recently introduced *A. Omorika* from South-eastern Europe. *A. Alcockiana* grows on the higher slopes of Fusi-yama, along with *A. Veitchii* and *Larix leptolepis*, where it is less common than our *ajanensis*.

Abies Tsuga, the Japanese Hemlock Spruce, is a more ornamental tree than the Canadian species; its foliage is of a brighter and more attractive colour. Thirty years' experience of it in this country has proved its hardiness in the southern, western, and midland counties, and probably further north. In its native country it spreads as far south as Kiusiu, often mixed with *A. firma*, and attains a height of 100 feet. A second species, called by Maximowicz and Mayr *diversifolia*, but known in British gardens as *Tsuga nana* or *Tsuga Sieboldii*, for there is, I think, but little doubt that they are the same, is an alpine tree growing near the upper limits of the timber-line on the central mountains. In this country it grows slower than the typical *Tsuga*, to which as an ornamental tree it is quite subordinate.

Larix leptolepis differs from the European Larch in its longer leaves, which are glaucous when first developed, in its differently shaped cones, and in other details; it grows much more slowly, and hence is more suitable for decorative than for economic use. Its ornamental qualities are well developed at Tortworth, where there is a fine specimen in front of the mansion. This tree has a more spreading habit than the common Larch; its aspect is light and open, and affords an excellent contrast to the broad-leaved trees standing around it. In its native country *Larix leptolepis* is an alpine tree ascending in places to near the snow-line, where it is often distorted by the wind; at the lower limits of its vertical range it attains the dimensions of the European Larch.

We now come to the true Pines, of which there are five

(perhaps six) species, all, with one exception, available for the British Arboretum.

Pinus densiflora attains its greatest development on the sides of the hills in the interior, in places where no other tree can grow. It is known as the Red Pine in Japan, and often attains a height of from 100 to 120 feet. Good specimens are now growing in various parts of England, notably at Eastnor Castle, where there is a tree 25 feet high, which was planted in 1865; this gives the annual average growth at something less than 12 inches.

Pinus Thunbergii was figured and described by Siebold in his "Flora" under the name of *P. Massoniana*; it was also introduced by him under that name, whence it became current in European gardens; but as another Pine from China had been previously figured and described as *P. Massoniana*, we must adopt Parlatore's name, "*Thunbergii*," for the Japanese species. This is the Black Pine of the natives, and attains its best development near the coast, which suggests that it would be suitable for our own seaside if not too much exposed. It is far less common than *P. densiflora*, and so few seedlings have been raised in this country that it is still comparatively rare. The best specimens known to me are in the Royal Gardens at Kew.

Pinus koraiensis is believed to have been originally introduced into Japan from the Corea, but so long ago that it may be regarded as indigenous. Its height and size vary much with the soil and situation; in some places it is 50 feet high, in others not half so much. It is comparable with the Cembra Pine of Europe, but more spreading in its habit. In this country it grows freely and soon forms a handsome specimen.

Pinus parviflora.—Under this name we have two distinct forms, that introduced by J. Gould Veitch, and called the cultivated *parviflora*, and that introduced by Maries, which he calls the wild *parviflora*. Mayr has observed both forms in their native home, and expresses his opinion that the cultivated *parviflora* is a transitional form between *Cembra* and *Strobus*, and that the wild form is a true *Strobus*, and specifically distinct from *parviflora* (giving his reasons for that conclusion). The wild form, as we call it, is the most robust of the two; it belongs to the cooler region of Nippon, and spreads farther north than *parviflora*. The latter, as we see it, is one of the most distinct,

and certainly one of the most ornamental of the small Pines; it may be used as a decorative plant where the larger Pines are unsuitable.

Before dismissing the Japanese Pines, a circumstance of exceptional interest in connection with two of them should be noticed; this is Mayr's hypothesis of the existence of natural hybrids between *Pinus densiflora* and *P. Thunbergii*. Seminal variations among Conifers are common occurrences, of which many striking instances of known origin are now in cultivation. In the case of the two Pines in question, Mayr detected intermediate forms in which the characteristics of the two species are so intimately blended that they cannot be regarded as seminal variations either of the one or the other. He observed two groups of these supposed hybrids, one approaching nearer the Black Pine (*P. Thunbergii*) and the other nearer the Red Pine (*P. densiflora*); he thence infers that one group must have resulted from the opposite cross of the other. When we bear in mind the enormous quantity of pollen produced by a single Pine-tree, which, when shed, is blown by the wind in clouds, sometimes to a great distance, the possibility of the cones of one species being fertilised by the pollen of a closely allied species commends itself to us as a very possible natural event.

To return to our review of the Coniferæ of Japan.

Sciadopitys verticillata, or the Umbrella Pine as it is often called, is one of the most remarkable monotypes in the Order. It has now been in our midst more than thirty years, but there are not yet to be found in this country specimens 30 feet high, or even half 30 feet, or if so they are extremely rare. Complaints reach us from all parts that it will not grow, and yet the answer to these complaints is simple enough, and may be thus formulated. *Where the Rhododendron thrives the Sciadopitys will grow.* This means that the soil in which it is planted must be sufficiently retentive to afford a constant supply of moisture to the roots while the tree is growing. Where this supply is intermittent—that is to say, when the *Sciadopitys* is planted in a soil that is sometimes dry and sometimes wet, according to the changes of weather—it will not grow. In the highly saturated atmosphere of Central and Southern Nippon, the *Sciadopitys* towers to a height of 100 feet. In the moist climate of Cornwall, where the annual rainfall is greater than

in most other parts of England, the finest specimens in England are to be found.

Cryptomeria japonica is now become one of the most familiar of Japanese Conifers, yet it is a remarkable fact that the *Cryptomeria* we so often see is not the Japanese type, but a variety of it brought from Shanghai in China by Fortune in 1844 ; but it may perhaps be accepted as the representative of the Chinese type, for there is now sufficient evidence at hand to show that the *Cryptomeria* is indigenous to both countries. Much nearer the Japanese type is the variety known as Lobb's *Cryptomeria*, which was introduced from the botanic garden at Buitenzorg in Java ten years later than the Shanghai form. Maries sent us in 1879 what he affirms to be the true *Cryptomeria japonica*, but any opinion at the present time as to its merits as an ornamental tree would be premature. The two forms introduced by Fortune and Lobb respectively are too well known to need description ; the variability in habit of the one and the comparative constancy of the other have been frequently remarked. Of the numerous varieties and sub-varieties of Japanese origin that called *elegans* is well known as the most distinct and most useful for ornamental planting. Its striking aspect and peculiar hue in winter is owing to the foliage consisting entirely of the primordial leaves ; hence it is what is called a juvenile or larval form, a phenomenon by no means unusual among the Coniferæ, especially in the Cypress tribe. *Retinospora squarrosa*, *R. ericoides*, *Biota meldensis*, *B. decussata* (all properly Thuyas) are instances of perpetuated juvenile forms. Perhaps the most curious fact about *Cryptomeria japonica elegans* is that it retains its primordial character so long. Trees of it from twenty to twenty-five years old show no tendency to develop the normal foliage of the species, although a slight difference in habit among them is observable, due probably to local circumstances. At Linton a tree nearly 30 feet high presents to the eye a dense mass of foliage with an irregular outline caused by the weight of snow resting upon it last winter ; at Tortworth the trees are more formal, more open, and the bole more or less exposed. In the more humid climate of Cornwall, at Tregothnan and Scorrier for example, where they grow more rapidly, their tops bend down under the weight of the branches and foliage, and during the storm of last

March some were broken off at a few feet from the ground ; at Pencarrow and Menabilly they are more upright ; but in all the cases observed the larger trees had formed a colony around the parent stem, the lower branches sweeping the ground, often rooting, and the ends of the branches ascending like the leaders of the parent.

Six or seven species of the Cypress tribe are peculiar to Japan, and three or four others are common to that country and China. Four of the endemic species are brought under *Thuya* in the *Genera Plantarum*, but for the convenience of horticulturists I will use the names by which they are best known ; the others are Junipers. One of the former, a true *Thuya*—*T. japonica*, or *Standishii*, as it is sometimes called—is a handsome species worthy of a place in any garden, and saying thus much of its merits, time forbids further mention of it. Undoubtedly the first place in the *Thuya* group must be assigned to *Thuyopsis dolabrata*. Comparatively slow-growing in the early years of its life, whether raised from seed or from cuttings, the older plants are now developing into stately trees that at once arrest attention by their distinct habit and foliage. Almost everywhere the finest specimens present the aspect of a conical outline with a very broad base in proportion to the height. The largest specimen known to me is at Killerton, near Exeter, which is now 25 feet high, and the spread of its branches at the base covers a circular area fully 18 feet in diameter. This tree has a history of its own, for it or its parent seems to have been introduced prior to the multitude of plants now distributed over the country. A plant was brought, presumably from Japan, by Captain Fortescue and presented by him to the late Earl Fortescue at Castle Hill ; from this three were propagated, and one of them, which has developed into the specimen in question, was presented to Sir T. Dyke Acland. It would be highly interesting to know the exact date of the introduction of the parent plant.

The *Retinosporas* now constitute a group of great interest ; but before noticing the most conspicuous members of it, it will be right—nay more, it will be rendering a service to horticulture—to emphasise the fact here that the name *Retinospora* can have no place in scientific nomenclature ; even its orthography is faulty, and horticulturists will show a wise discrimination in grasping this fact. The changing of names, especially of

popular plants in common use, is always an irritating inconvenience, but when the inevitable occurs the best course is to accept it. For the nonce let us call this group of Conifers Retinosporas, and, numerous as they are, they have all been derived from two, and only two, types or species, so surprisingly polymorphous have these species proved under Japanese cultivation. The two species are *obtusa* and *pisifera*, and the numerous varieties of Retinospora naturally fall into two groups, of which these two species are the types. In its native country *R. obtusa* is a lofty tree, often attaining a height of 150 feet where the annual rainfall is greatest; *R. pisifera* is a much smaller tree. In Great Britain the proportions thus far are reversed; the tallest observed specimens of the former do not exceed 30 feet, while specimens of *R. pisifera* are to be seen 40 feet high. Both in habit and aspect the two species may be readily distinguished from each other; in *R. pisifera* the branches, both primary and secondary, are longer and more slender than in *R. obtusa*, and the tree more open. *R. obtusa* has a more regular conical outline, denser in aspect, deeper in colour. Neither of them have the massive, almost columnar growth of their North American affinities, *Cupressus Lawsoniana* and *C. nootkatensis* (*Thuyopsis borealis*).

The varieties of both species are dwarfer, more compact, and of slower growth than the types. Of the *obtusa* varieties *filicoides* and *lycopodioides* are dense bushes remarkable for the peculiar form of their branchlets and the rich green of their foliage; the best-coloured form is *gracilis aurea*, the smallest is *pygmæa*, a dense tuft useful for the rockery. Of the *pisifera* varieties *plumosa* is a universal favourite; its sub-variety *aurea* and *pisifera aurea* are the richest-coloured forms to be found among Retinosporas, while *squarrosa*, a juvenile form, is almost unique in its grey primordial foliage; *filifera* also is a striking form on account of its slender drooping branchlets. The chief drawback attending these Conifers is that they will not grow everywhere; they fail entirely in a chalk soil and in soils with a limestone substratum. Even amidst the rich coniferous surroundings at Eastnor Castle, Mr. Coleman informs me that the Retinosporas do not thrive. A good retentive soil with a porous substratum suits them, such as we find in the sandy loam at

Tortworth, in the Kentish rag at Linton, and in the Wealden clay at Warnham Court.

I have already detained you so long that the remaining Japanese Conifers must be briefly disposed of. *Juniperus rigida* is one of the best of Junipers for ornamental planting when it is free from the attacks of red-spider, for, unfortunately, this proviso must be added. Two coloured dwarf forms of *Juniperus chinensis*, brought from Japan by J. Gould Veitch and named respectively *aurea* and *aureo-variegata*, have proved constant. The Taxads include some useful and distinct forms, notably the fastigate variety of *Cephalotaxus pedunculata* and *Torreya drupacea*, which has in places adapted itself to our climate better than any other *Torreya*. The Japanese Yew is distinct from all the seminal varieties of the common Yew, but perhaps not quite so generally hardy.

The foregoing is necessarily an imperfect sketch of the Japanese Coniferæ, because I am unwilling to encroach further upon the available time of this Conference, and because the field of observation has been a limited one—a deficiency, I trust, that will in a great measure be made good in the reports which the owners of Pineta and amateurs of Coniferæ have been invited to furnish. Nevertheless, some general conclusions may be arrived at which may be thus summarised :—

The whole of the Coniferæ of Japan indigenous to that country between the 35th and 40th parallels are available for the British Arboretum under certain restrictions, chiefly of soil and situation.

The members of the Fir and Pine tribe grow generally in a greater variety of soils and situations than those of the other tribes, and with them may be associated the *Cryptomeria* and its varieties.

The members of the Cypress tribe, especially the *Retinospora* group, and the Taxads are more capricious. The *Retinosporas* only thrive under the conditions already mentioned.

The most restricted at present is the *Sciadopitys*, but this requires a more extended trial.

The general hardiness of the Japanese Coniferæ must ever make them valuable in this country for ornamental planting, and the variety of form and colour to be found among them must always render them favourites with all who plant for effect.

CONIFERS AS SPECIMEN TREES AND FOR LANDSCAPE GARDENING.

By Mr. GEORGE NICHOLSON, A.L.S., F.R.H.S.

THE subject on which it has fallen to my lot to speak is a rather formidable one, and would require, for anything like an exhaustive treatment, much more time than is available at this Conference, where Conifers have to be looked at from other points of view than that of ornament. Were time not so much an object, and space no object at all, an entire volume of the Society's *Journal* could be filled without the question being thoroughly thrashed out. It would scarcely be possible for one man to give, from his own experience, a series of lists which could be relied on by planters in all parts of the British Islands. Not unfrequently—even where soil and some other conditions seem nearly identical in character—various Conifers thrive remarkably well in one spot, and in another, a few miles away perhaps, do not succeed nearly so well, or refuse to grow at all. It is to be hoped that this Conference will be the means of bringing together, focussing, and arranging experiences of this sort for our own benefit as well as for that of future planters. Many Conifers seem to be indifferent to soil and situation, provided that such physical conditions obtain as efficient drainage and shelter, as well as absence of smoke. All Conifers object strongly to a smoke or dust-laden atmosphere, and that is why none thrive for any lengthened period in the immediate neighbourhood of a large town. A partial exception to this rule may perhaps be made in respect to the Ginkgo or Maidenhair-tree of China and Japan (*Ginkgo biloba*), which I have seen growing freely in the High Street of Brentford, the branches overhanging the pavement.

Since writing the foregoing sentence I have been to Brentford to see the tree in question. Not many years ago it was a remarkably fine specimen, but the leader is now dead and it will probably not last much longer. It is to be found between the gasworks and the Royal Brewery, and extension of buildings seems to have injured the roots and restricted the space available for them to work in.

Comparatively few Conifers like a cold water-logged soil, some thrive in very barren dry soil, but the majority like good rich ground, well drained. Pines, as a rule, succeed in dry stony land, where Firs soon get covered with red-spider and become stunted and unsightly; generally speaking, the Firs like more moisture in the soil than Pines, and a cool bottom.

It may be as well to say here that I do not intend entering into a long disquisition on the merits or demerits of Conifers as elements in the landscape. No doubt a park where Conifers predominate very markedly lacks the beauty and variety of another in which, Conifers not having been overlooked in the arrangement, due advantage has been taken of fine deciduous timber and other ornamental trees. There are places where under the stress of a great love for Conifers, the owner has got together a fine series of Pines, Firs, and their allies, but has only succeeded in producing a general effect of sombreness and sameness objectionable from the artistic point of view.

All the taller-growing Conifers make striking objects either as single specimens or in groups, and, skilfully arranged, may be made to play an important part in the landscape. Wonderful colour-effects are at the command of the planter who knows how to make the best use of the material at his command. From the soft light green of the Larches and deciduous Cypress to the black-green of the Austrian Pine there exists an extraordinary series of shades. The leaves of the Golden Larch assume a fine rich golden yellow before falling, and those of the deciduous Cypress a fine brown. The young growths of many, too, contrast strikingly with those of previous years. In the following list—which could be very considerably extended for many localities—only the hardiest are given; those, in fact, which may be most generally recommended. It will probably be somewhat of a surprise to many that the Douglas Fir finds no place in this selection of large-growing Conifers for parks. In Scotland and elsewhere I have seen magnificent specimens; I have also seen the species fail completely in many places where most of the Conifers I name succeed admirably. The Deodar is another case in point.

The nomenclature adopted (except in one or two instances) in this paper, as also in the collection of specimens exhibited by Kew, is that of Beissner's "*Handbuch der Coniferen-Benennung*,"

a useful little book which all Conifer lovers and growers should possess.

LARGE-GROWING CONIFERS FOR PARKS.

<i>Taxodium distichum</i>	<i>Cedrus atlantica</i>
<i>Taxus baccata</i>	<i>Larix leptolepis</i>
<i>Ginkgo biloba</i>	" <i>europæa</i>
<i>Pinus contorta</i>	" <i>americana</i>
" <i>Pinaster</i>	<i>Picea nigra</i>
" <i>silvestris</i>	" <i>alba</i> , the White Spruce
" <i>Laricio</i>	" <i>pungens</i> and <i>p. glauca</i>
" <i>austriaca</i>	" <i>excelsa</i> and tall forms
" <i>Coulterii</i>	" <i>polita</i>
" <i>Sabiniana</i> , the Digger Pine. At Kew this is perfectly hardy and forms, with judicious pruning, a fine tree; the very large seeds were formerly much used as food by the Californian Indians.	" <i>orientalis</i>
<i>Pinus ponderosa</i> , the Yellow Pine	" <i>ajanensis</i>
" <i>rigida</i>	" <i>sitchensis</i>
" <i>Cembra</i>	<i>Tsuga Mertensiana</i>
" <i>excelsa</i>	" <i>canadensis</i>
" <i>Peuce</i>	<i>Abies Nordmanniana</i>
" <i>Strobus</i> , the Weymouth Pine	" <i>numidica</i>
" <i>monticola</i>	" <i>Pinsapo</i>
<i>Cedrus Libani</i>	" <i>brachyphylla</i>
	" <i>nobilis</i>
	" <i>concolor</i>
	<i>Thuja gigantea</i>
	" <i>occidentalis</i>
	<i>Chamaecyparis Lawsoniana</i>

SMALLER-GROWING CONIFERS AS SINGLE SPECIMENS FOR LAWNS, &c.

Only a limited selection is here given; no attempt is made to give an exhaustive list. Where the aim of the planter is not to bring together within his limits all the species and varieties possible, he could probably not do better than choose from the names given below:—

<i>Thuja occidentalis</i> Wareana	<i>Sciadopitys</i> . This likes plenty of moisture and does well in peat.
" " <i>Vervaeana</i>	<i>Pinus Banksiana</i> , the Scrub or Gray Pine; a low shrub or tree rarely exceeding 20 feet in height.
" <i>plicata</i>	<i>Pinus Pinea</i>
<i>Chamaecyparis Lawsoniana</i>	" <i>tuberculata</i> . A handsome Pine, remarkable for the crowded whorls of cones which, in a wild state, persist on the stems and branches from bottom to top until the destruction of the tree by fire, when the cone-scales open with a loud report, setting free the transparent-winged seeds, to be carried away by the wind and, perhaps, reforest the region.
" <i>pisifera</i>	
" <i>nutkaensis</i>	
" <i>obtusa</i>	
" <i>sphaeroidea</i>	
<i>Thuyopsis dolabrata</i>	
<i>Biota orientalis</i>	
<i>Juniperus chinensis</i> and var. <i>aurea</i>	
" <i>virginiana</i> and vars.	
" <i>arizonica</i>	
" <i>Oxycedrus</i>	
<i>Cryptomeria japonica</i>	
Yews	
<i>Cephalotaxus</i>	

Pinus silvestris fastigiata and *P. silvestris aurea*
Pinus densiflora
 „ *flexilis*; a Rocky Mountain Pine and the most valuable timber tree of Central Nevada.
Pinus Bungeana, the Lace-bark Pine of China
Pinus Balfouriana, the Californian Fox-tail Pine
Pinus koraiensis
 „ *parviflora*
 „ *edulis*, the Piñon or Nut Pine; a small compact-growing tree, whose large edible seeds furnish to the Indians a valuable article of food; it occurs wild from Colorado to New Mexico and Arizona.
Pinus monophylla, another species called the Nut Pine; a small, bushy, compact-growing tree, in a

wild state attaining a height of from 10 to 20 feet, with a trunk sometimes 2 feet in diameter; the large edible seeds are invaluable to the Indians of the “Great Basin,” and are their principal article of food.
Pinus Gerardiana, a species from Afghanistan, is also of great importance as a food-producer to the natives of the districts where it grows wild; in cultivation, as far as my experience goes, however, this seems to barely do more than exist; our Kew plants are small, miserable objects, and do worse than any other Pine cultivated in the open air in the Royal Gardens. Can anyone furnish more favourable particulars of this interesting Pine?
Tsuga Sieboldii
 „ *Pattoniana*

CONIFERS WHICH HAVE BEEN FOUND TO SUCCEED ON CHALK.

Norway Spruce
Cedrus atlantica
Abies Pinsapo } These do wonderfully well
 „ *cephalonica* } also on peat
 „ *nobilis* }
Pinus austriaca
 „ *Laricio*
 „ *Pinaster*
 „ *silvestris*
 „ *excelsa*
 „ *insignis*
Larix europæa
 „ *leptolepis*
Chamaecyparis Lawsoniana
 „ *nutkaensis*

Cupressus macrocarpa (the Monterey Cypress). This requires more shelter than the rest of those named. Both this and the Monterey Pine (*Pinus insignis*) are limited to a few miles of the Monterey coast.
Biota orientalis, the Chinese Arborvitæ
Thuja gigantea
Thuja occidentalis, the common Arborvitæ of eastern North America
 Junipers, most of the species
 Yews, most of the species and very numerous varieties
Ginkgo biloba

The *Wellingtonia* (*Sequoia gigantea*) and Deodar also thrive on chalk, but neither has, as a rule, come up to the expectations of the planters of from twenty to thirty years ago. For landscape purposes both have, in thousands of instances, proved useless. Neither can stand a windy, exposed situation, and the Deodar frequently begins to grow too early and is cut by late frosts. A form of the Deodar (*Cedrus Deodara*, var. *robusta*), with larger leaves of a darker green colour, begins to grow much later than the type, and is more valuable as a hardy ornamental tree. Probably this is a geographical form, and not a mere garden sport. The *Wellingtonia* appears to like a warmer climate than

that of Britain. I have seen perfect specimens in the neighbourhood of Tours and in other parts of Western France, also about the Lake of Geneva, &c.

CONIFERS SUITABLE FOR WET GROUNDS.

Most of the trees here mentioned grow naturally in swampy places or along the borders of streams; most of them, it is true, thrive perfectly in cultivation under widely different conditions, and their names have been mentioned under some of the headings already given. This list could doubtless be greatly extended. First and foremost is the deciduous Cypress, of which the finest specimens I have seen are in the grounds of Syon House, the residence of the Duke of Northumberland, an ardent lover of trees. One of the many fine deciduous Cypresses in Syon Park has developed numbers of the characteristic *knees* which form so striking a feature of the species in its wild habitats.

Thuya occidentalis.—The garden varieties of this tree would probably also succeed as wet-ground plants.

Chamaecyparis sphaeroidea, the White Cedar of the eastern United States. In a wild state this always occurs in deep cold swamps. The interesting and pretty garden forms of this are no doubt equally as suitable as the type for margins of water, &c. It may perhaps sound strange to some to be told that the so-called *Retinospora leptoclada* is a form of the American White Cedar, but so it is.

In Veitch's "Manual of the Coniferæ," an extremely useful book, to which I am indebted for much valuable information, the Red Cedar (*Juniperus virginiana*) and three of its varieties are recommended for planting in proximity to ornamental water, as are also *Juniperus recurva* and its variety *densa*. *Taxodium distichum pendulum*, formerly known under the name of *Glyptostrobus pendulus*, and at one time believed to be a Chinese tree, should, like the common deciduous Cypress, be planted near water where it is possible to do so.

Pinus contorta grows naturally in wet sandy soil, but under cultivation it also thrives on a dry, hungry gravel.

Pinus rigida, the Pitch Pine, also grows in the driest and most barren sandy soil or in deep swamps; this species is interesting on account of the numbers of adventitious buds which are produced on the stem and larger branches, giving the tree an

aspect totally unlike that of any other Pine I have named. It may be as well to mention that the Pitch Pine of the timber-merchant is not furnished by this species, but is principally derived from *P. australis*, a long-leaved rather tender Pine whose native habitat is the southern United States.

The American Larch or Tamarack (*Larix americana*), within the limits of the United States, is, according to Prof. C. S. Sargent's "Catalogue of the Forest Trees of North America," always found in cold damp swamps. Under these conditions, however, it is not of such value as a timber-tree as in Labrador and Newfoundland, where it is not confined to swamps.

Tsuga canadensis, the Hemlock Spruce, I have seen do well near water; in a wild state it is found in rather dry, rocky situations, and generally on the north side of hills. *Picea sitchensis* or *Menziesii* I have seen attain a large size in Scotland in wet spots; in Alaska and California it is found in wet sandy soil generally near the mouth of streams.

CONIFERS FOR THE SEASIDE.

Cupressus macrocarpa, the Monterey	Pinus austriaca
Cypress	" Pinaster
Pinus Laricio	" insignis

P. Pinaster has been planted over immense tracts in the Landes, adjoining the Bay of Biscay, and has served a double purpose by binding the sand and also forming a screen, thus preventing the great damage done by the frequent sand-storms, which drove the sand-dunes inland and made them encroach annually, at a rather alarming rate, on the cultivated ground. *P. halepensis*, the Aleppo Pine, I have seen growing almost close to the water's edge along the Mediterranean coast, and in rocky barren spots too where scarce another tree was to be seen. *P. Pinea*, the Stone Pine, also occurs along the Mediterranean under similar conditions. It would seem that these two species might thrive, at any rate in sheltered places, along our south, south-western, and western coasts. Have experiments to this end been tried to any extent?

Gilpin, in his "Practical Hints on Landscape Gardening," says: "It would seem that the Silver Fir stands the sea-breeze, as some of the largest I ever saw are growing upon the highest point of land at Tregothnan; but not having met with them

anywhere else under such circumstances, I can only state the fact. I have, in one or two instances, found the Cedar of Lebanon flourishing under nearly similar exposure." Possibly some one at this conference may be able to Corroborate Gilpin, and add further names to my short list of seaside Conifers.

Pinus muricata grows along the Californian coast exposed to sea winds and fogs. Has this been tried as a sea-coast plant in Britain? It does well inland, at Kew and elsewhere, but, like *P. insignis*—at Kew at any rate—is more liable to be injured by the attacks of the larvæ of *Hylurgus piniperda* than most other Pines. The cones of *P. muricata* have been known to persist twenty or thirty years, and then release good seeds.

CONIFERS OF SMALL SIZE SUITABLE FOR ROCKWORK, &c.

<i>Thuya occidentalis</i> Ellwangeriana	<i>Taxus baccata</i> Dovastonii
<i>Chamæcyparis</i> Lawsoniana nana	<i>Podocarpus</i> alpina
" " " glauca	<i>Pinus silvestris</i> pygmæa
" obtusa nana	" montana
" " " aurea	" <i>Laricio</i> pygmæa
<i>Juniperus</i> Sabina prostrata	" <i>Strobus</i> nana
" chinensis nana; or, as it is	<i>Picea nigra</i> Doumettii
sometimes called, <i>J. japonica</i>	" excelsa Clanbrassilliana
" nana	" " pygmæa
<i>Taxus baccata</i> ericoides	<i>Cryptomeria elegans</i> nana

DISCUSSION.

The Rev. C. WOLLEY DOD was surprised to find that Mr. Nicholson had excluded the Douglas Fir from his list of trees recommended for ornamental grounds. Twenty-three years ago Mr. Dod had gone to live a few miles south of Chester, where the soil was the stiff boulder clay of the New Red Sandstone formation, with a cold and wet subsoil. There were then no Conifers on the estate, except a few Larch and Scotch Fir. The prevailing timber was Oak. Mr. Dod consulted Mr. John Standish, then at Ascot Nurseries, and proceeded to try in Cheshire every Conifer recommended as likely to prove ornamental or useful. New enclosures were made, old plantations cut down and renovated, and every chance given to the trees to do well. Of all the Conifers then planted the Douglas Firs have done decidedly the best. Several hundred of these were planted in different situations and aspects, and, except where exposed fully to westerly gales, they have universally done well, some of them being now over fifty feet high and well furnished. Of the

Pine tribe the Corsican Pine has been most successful, having grown rapidly; though for a few years they were liable to be blown down, they have stood well when fully established. This Pine was less molested than others by rabbits. The Austrian Pine makes excellent shelter, but, except the Scotch Fir, other Pines have failed, as compared with the Spruce tribe. The Nordmann's Silver Fir, however, has done worse than any. Mr. Dod had persevered with this very ornamental tree, and had planted several hundred in successive years, and in every variety of aspects, but hardly one now survived, and he considered this species a total failure for stiff and cold land.

Of other kinds, two or three specimens of *Abies grandis* had done very well in rather exposed places. *Cedrus atlantica* was exceptionally good. *Abies Pinsapo* had proved hardier than he expected. *Sequoia gigantea* seemed satisfied with the soil and climate, but was not a favourite. *Cedrus Deodara* and *Abies nobilis* promised fairly well, except that the last-named produced cones in great abundance, showing precocious maturity. *Cupressus Lawsoniana* was a success everywhere; but *Taxodium sempervirens*, the Redwood, from which he had hoped great things, because he had seen it do so well on the stiff soil of Windsor Great Park, had failed entirely, in spite of repeated trials. Mr. Dod hoped these hints might interest any who were intending to plant Conifers on soils similar to his own.

CONIFERS FOR ECONOMIC PLANTING.

By Mr. A. D. WEBSTER, F.R.S.E.

It is a strange fact that out of nearly two hundred and fifty species of coniferous trees that have been introduced to this country only the following sixteen, so far as is at present known, can be utilised in an economic sense, or for truly profitable planting. Equally strange it is that, with perhaps one exception, the very trees the timber of which is imported in such large quantities to this country for constructive purposes have received but little attention at the hands of the British planter, being found

unsuitable in one way or another for extensive planting in almost every part of the country.

At the outset it may be well to clearly set forth my intention of bringing under your notice, and, as far as I can, in consecutive order as to value, only such Conifers as can from long personal experience be confidently recommended for profitable planting in almost any part of the British Isles.

The terms "profitable" and "economic" as applied to trees are used here in rather a restricted sense, and refer directly to the quality of the timber produced and to the value of the tree for purposes of shelter.

(1) The Common Larch (*Larix europæa*) has no equal as a profitable timber Conifer in this country, and I make this statement after years of note-taking and comparison of it with three other Conifers whose merits place them high in the rank of kinds suitable for economic planting. In dealing with the Larch I might well sum up its valuable properties as follows: First, no other Conifer is so valuable in a young state, as the thinnings from eight years old can be profitably utilised for fencing and various other purposes, and this can be said of no other Conifer grown in our woodlands; at least the durability of the timber would not in any other tree be sufficient to repay the cost of erecting or otherwise converting. Then the Larch is a hardier Conifer than any other I know of, being in this respect quite equal to the Scotch and Austrian Pines, while it will produce timber rapidly on very poor soils, and timber which, on comparison, is of greater durability, besides being cleaner and more easily manipulated than that of any other coniferous tree grown in this country. Another point or two in favour of the Larch may be briefly pointed out.

Comparatively speaking, the trunk of the Larch is neither knotty nor crooked—points that are much favoured by timber-merchants—and I am not now referring simply to such trees as are grown closely in a plantation, but to isolated specimens, for above all trees the Larch is the one that is least inclined to throw its vigour and substance into the formation of ungainly side-branches. One other point in favour of this valuable tree is that a greater number can be grown to the acre, or, in other words, the number of cubic feet of Larchwood that can be produced from an acre is greater than that of any other Conifer I know.

Unfortunately, of late years in particular, this valuable tree has, in certain situations and under peculiar circumstances, suffered much from canker and blight, but now the tide of destruction seems to be on the wane, and less and less is heard of this fell disease.

By far too little attention has been paid to a careful selection of seeds from sound and healthy trees, the result being that weakness and tenderness have got into the constitution of the tree, and it is thus unable to withstand even a few degrees of frost. So weakened, blight, fungus, and ulceration find a footing, and thus the fell disease is generated about which so much has been said and written of late years. My own opinion, strengthened by careful investigation and research, is that induced tenderness in the constitution of the Larch is the primary cause of disease, cold winds and frost the destroying agent, and ulceration the direct consequence. If we followed more closely Nature's method of dealing with the cones and seeds of this, as well, indeed, as of other trees, we should have less sickly and degenerating forest occupants, and far less cause for the constant wail regarding the decline of this noble and valuable timber-producing tree.

In its native country, the Tyrol, the seeds of the Larch are never scattered from the cones until March and April, after having been fully exposed and their contents thoroughly matured by a winter's frost. A comparison of such seeds with those annually procured in this country, from which our stock of plants is mainly raised from year to year, reveals marked differences, for not only are our home supplies of cones collected in November before maturity is nearly attained, and when only partially if at all wintered, but these are kiln-dried, so that the immature cones may part with their seeds—in my opinion a most pernicious practice.

With such treatment there can be little wonder why our once healthy Larch is fast becoming unhealthy and gradually but surely degenerating, as the reports from almost every part of Great Britain too truly confirm. To further add to the evil, the large demand for Larch seed creates rather a keen competition for it to be supplied in time for early spring sowing, and so it is that instead of the cones being allowed to winter on the trees, they are collected in the greatest quantity in the autumn or early winter so as to be forwarded in time to meet the demand.

It is also well known that sickly trees, as if by a last dying effort so as to propagate their kind, bear an unusually large quantity of seed, and as these are in nine cases out of ten collected at so much per sack or bushel, can it be wondered at that the bulk of our home-saved seed is partially unfitted for reproductive purposes? It is well known that a diseased tree cannot bring forth good fruit.

The durability of the wood of the Larch is well known, and, as compared with that of Scotch and Spruce Firs, is about doubly durable. A fence of Larch cut from trees of from twenty to thirty years' growth will last from seventeen to twenty years, while that of the Spruce lasts about nine years, and Scotch Fir five years. This refers directly to rails, not to posts, which decay in about half that time. For mining and railway purposes the durability of Larchwood makes it much sought after, its value being still further enhanced by its extreme lightness, a cubic foot of seasoned wood weighing only 34 lbs. Substitutes for the Larch have often been recommended, but in the true sense of the word none can be termed substitutes, except, indeed, in the narrowest sense, although doubtless some of those whose claims will yet be set forth might reflect one or more of its valuable qualities, but this is the widest limit of comparison.

(2) The Silver Fir (*Abies pectinata*) is, so far as our present knowledge leads us, the next most profitable Conifer to the Larch that is cultivated in this country. Be it remembered, however, that in a quarter of a century or so at least two other Conifers may be found to be equally profitable as British timber-trees with the Silver Fir, but at present we must deal with facts. On several occasions I have pointed out that the Silver Fir is a neglected forest-tree in this country, and that its timber is of far greater value than is generally supposed. The experiments made or conducted on the Highland Railway proved so far that the timber of this tree will bear the wear and tear of rolling-stock and stand the climatic changes equally well with the best Pinewood from Norway; indeed, when last I saw the experimental sleepers, those of Silver Fir were equally sound with the Norwegian samples.

For roofing, few boards can equal those of the Silver Fir; indeed, amongst all the Conifers grown in this country, I consider it to be one of the best, as producing timber that is not liable

to be affected by sudden changes from wet to dry. I have used it largely for cleading sheds and strengthening river embankments, as it stands the vicissitudes of dry and damp alternately better than almost any other home-grown timber.

Another point in favour of Silver Fir timber is that, owing to its being procurable in greater widths than that of any other tree, if, perhaps, we except the Douglas Fir, the cost of utilising is considerably lessened in proportion. The tree itself will grow well beneath the shade and drip of other trees; grows with greater rapidity and of a larger size than almost any other; is, practically speaking, fairly free from disease, and does not require a particularly rich soil to grow it to perfection—all points of great moment in treating of Conifers for economic planting. From long experience of the timber of the Silver Fir grown in this country, it may be safely said to be of great value for constructive purposes, and numerous experiments carried out by those who are practically acquainted with the conversion of our home-grown timbers only serve to show that the wood of the Silver Fir is not employed in anything like the quantity that its merits deserve.

(8) The Corsican Pine (*Pinus Laricio*) is another Conifer of great value for profitable planting in this country, and one that I make bold to say will yet outrival in this respect any other of the family to which it belongs. It is of very rapid growth, and is well suited for planting even in the most exposed and wind-swept situations; a non-fastidious subject as to soil, and withal perhaps the most valuable timber-producer, excepting the Larch, that has ever been brought before the British arboriculturist.

Having as yet been tested to no great extent for timber-producing purposes, it may, perhaps, be premature to speak too loudly in support of its qualities in that respect; but as I have cut up and utilised in various ways some of the biggest logs that have ever been grown in this country, I may be allowed to at least venture the remark that the timber is of excellent quality, and peculiarly suitable for constructive purposes. Speaking of trees of fully fifty years' growth, I have found the wood strong, tough, elastic, very resinous, and easily worked. I have experimentally used home-grown Laricio wood for many purposes, and always with the most satisfactory results—some of the largest planks employed in this way being fully 27 inches wide, and

cut from trees with a girth of nearly 9 feet at a yard from the ground. Planks that were used for several purposes both in and out of doors have stood a test of nine years in such a manner as to give one the impression that few of our home-grown coniferous woods can equal that of the Pine in question. The Corsican Pine can withstand long-continued and cold blasts at high altitudes in an exemplary way, as note those in a plantation of forty acres extent that I had planted at nearly 1,000 feet altitude on a spur of the Snowdon range of hills; those at Blair Athol, in Perthshire, at 700 feet; in Yorkshire, one of the most barren and wind-swept of English counties, as well as on Lord Powerscourt's estate, where it has been most favourably reported on by that veteran arboriculturist. At Chester, also, the specimens planted by Messrs. Dicksons, which I saw about a week ago, have in a given time produced a large quantity of valuable timber, as well as having withstood the fully exposed situation satisfactorily. In summing up, it may be said that the Corsican Pine is perfectly hardy, peculiarly well suited for planting in exposed situations, a rapid and valuable timber-producer, a tree that is cheaply and easily raised from seed, and one of the most non-exacting Conifers as regards choice of soil that could be named—all qualities of the highest value in a timber-producing tree, and such as are rarely so well concentrated in any other species.

The Prussian Government has introduced it extensively into the State forests, while in France extensive plantations of the *Laricio* have been made.

(4) The Douglas Fir (*Pseudotsuga Douglasii*) is, in certain situations, a valuable timber-producing tree; but to grow it to perfection rich alluvial soil and sheltered valleys are quite a necessity. Had we the cañons and deep hilly gorges of some of the States of North America, there can be no doubt that the Douglas Fir, from its suitability to our climate generally, would be perhaps the most valuable timber-producing tree that we could plant. In this country, under peculiarly favourable circumstances, I have known the Douglas Fir to produce 240 feet of timber in fifty years, or nearly 5 feet per year for half a century. The tree here referred to as having produced this almost fabulous quantity of wood is still growing at Penrhyn Castle, in North Wales, and as the notes and measurements were all

taken by myself, I can vouch for their accuracy. By way of experiment I had several large trees cut up and utilised for various purposes—fences, door-posts, boat-masts, &c., and with fairly satisfactory results; but of course it is yet premature to speak with too great an amount of assurance, as only nine years have elapsed since the experiments were instituted. I do not wish to say one word against this my favourite Fir, but the truth must be told, and my own experience, gained principally on a low-lying maritime estate, which favoured the growth of most trees, is that the Douglas Fir must occupy a sheltered situation if either ornament or utility be considered as points of importance; indeed, a lengthened experience gained on an estate where it is, perhaps, grown in greater quantity than on any other, has now fully convinced me that the Douglas Fir is an ill-chosen subject for exposed ground. Regarding the Douglas Firs in some of the Perthshire woods and plantations voluminous articles have been contributed by Dr. Schlich and others; but it might here be well to point out that scientific knowledge gained without practical experience is rather dangerous, and should be most carefully applied, particularly when dealing with matters arboricultural.

(5) The Weymouth Pine (*Pinus Strobus*), when viewed in an economic aspect, is well worthy of a fifth place on our list. In not a few ill-chosen places throughout the country this Pine has behaved in anything but a satisfactory way; but it should also be remembered that it has succeeded well and produced an unusually large quantity of clean and firm wood in various parts of Britain. This latter result is due to a careful study of the soils, as well, indeed, as of the aspect and altitude, that have been found best suited to the wants of the tree. Planted in rocky *débris*, largely intermixed with vegetable refuse, the tree has attained to giant proportions at Gwydyr Castle, in North Wales, as also at Longleat and other places we could mention. The Gwydyr trees are nearly 100 feet high, straight as arrows, and branchless for three-fourths of their length, and girthing fully 8 feet at breast high. At Strathkyle, on the western border of Ross-shire, at altitudes ranging from 100 feet to 1,200 feet, the Weymouth Pine is thriving splendidly, while the Longleat trees average 90 feet high, and girth 9 feet at a yard from the ground.

In thinning a mixed plantation of the Douglas Fir and Weymouth Pine of thirty years' growth, I noted that trees of

the latter were 57 feet high, with stems girthing 4 feet 2 inches at a yard from the ground.

On comparing the wood of the Weymouth Pine produced in this country with that sent to the late Colonial and Indian Exhibition, the differences were slight indeed, and nothing more than what would be expected to exist between an immature and perfectly developed specimen of the tree.

The Weymouth Pine dislikes cold and draughty situations, its favourite haunts being sheltered valleys at medium altitudes.

(6) The Scotch Pine (*P. silvestris*).—For economic planting the Scotch Fir will, in all likelihood, hold a high rank, it being of great value for planting on poor land in exposed situations. No doubt this Pine will continue to be planted extensively wherever shelter is of first importance, and rightly so, for few others are so capable of withstanding the cold, cutting blasts of our exposed hillsides. The almost valueless timber produced by the tree will always be a serious drawback to the extensive use of this particular species; but this is in great part counterbalanced by the hardy nature of the tree, the great amount of shelter it affords, and the rapidity of growth on poor, thin soils. Of late years in particular it has been well-nigh an impossibility to get rid of the timber at any price. The best quality of Scotch Pine-wood, such as that produced in some of the northern Scottish counties, no doubt realises, even at the present time, a fair price; but, generally speaking, that grown throughout Southern Scotland, in England as a whole, and also in Ireland, is of so inferior a quality as hardly to fetch the price of second-rate fire-wood.

(7) The Giant Arborvitæ (*Thuja gigantea*).—Being only forty years since the Giant Arborvitæ was introduced to this country, we must be careful in sounding its praises; but there can be little question that in it we have, whether for utility or ornament, a most valuable addition to our forest trees, and it is the opinion of most practical arboriculturists that it will be one of the trees of the future in this country. After a fair and impartial trial on my own part, I have found it to be perfectly hardy even at an altitude of 1,000 feet, a fast grower and rapid timber-producer, a non-fastidious subject as regards the quality of soil in which it is planted, and one of the easiest managed and most accommodating of trees. From my note-

book I find that the average annual rate of growth of twenty-six specimens, growing under dissimilar conditions, is 22 inches, but even this is greatly exceeded by young trees in the nursery border. The quality of timber produced in this country is such as to warrant me in speaking highly of it, and as the specimens experimented with were only of thirty years' growth, better results may be expected from more fully matured wood.

(8) The Norway Spruce (*Abies excelsa*).—The value of the Norway or common Spruce in economic planting is already well known, fully matured timber having been largely cut up and converted for not a few general estate purposes. Though not equal to either the Larch or Silver Fir in lasting qualities, the wood of the Spruce is yet sufficiently lasting to cause it to have been largely employed in fencing and in the erection of temporary sheds. One great point in favour of the tree is that it will grow where many others would fail, while it grows rapidly and affords a great amount of shelter.

(9) The Austrian Pine (*Pinus austriaca*), where shelter is a point of first moment, stands unrivalled by any other tree of my acquaintance. Of fairly good quality, too, is the timber; but it is generally rough, knotty, and hard to work. The tree inclines more to spend its energy in the formation of many weighty side-branches than in the building up of a clean and gradually tapering stem, and I have found that even by growing the tree thickly together the knotty side-branches are hard to remove. The Austrian Pine grows well on almost any class of soil, and bears exposure to rough winds, as I have more than once proved on the Welsh hillsides. Several large trunks I had cut up for the express purpose of testing the quality of the timber turned out well, the planks being remarkably resinous, of a dirty yellow colour, and rather hard to work. It stands the changes from wet to dry as well as any British timber I know, and the experiments I undertook on the Ogwen River nine years ago were perfectly satisfactory.

(10) The Cluster or Maritime Pine (*P. Pinaster*).—So far as the value of the timber of this Pine is concerned the tree might be described as almost valueless for economic planting. That it will thrive well and produce fine bushy specimens where few other trees could succeed has been well exemplified along the Mediterranean coast, as well, indeed, as in not a few maritime

districts of Great Britain. This of itself renders the tree one of great value, and eminently qualifies it for using as a nurse to other less hardy kinds. I have just learnt from a friend that the Pinaster is being largely planted at the Cape of Good Hope, and certainly the samples of wood forwarded to me for comparison with that produced in Britain left little to be desired.

(11) Nordmann's Fir (*Abies Nordmanniana*).—In a few years, when better known and more readily and cheaply procured, this beautiful tree will, I have little doubt, be largely used in the formation of woods and plantations in this country. It grows rapidly when suitably placed, a number of specimens of which I kept a record having produced nearly two cubic feet of wood annually, while the upward growth was 2 feet 3 inches in the same time. From the appearance of the wood of trees grown in this country, which have been cut up under my own supervision, the quality of that produced in its native country would seem to be well sustained, it being firm, clean, and readily worked.

(12) The Redwood (*Sequoia sempervirens*) is rarely recommended as a tree suitable for extensive or profitable planting, and yet my own experience of it in sheltered valleys is far from unsatisfactory. From actual measurements taken by myself in Lord Penrhyn's woods in North Wales, I have found that the yield of timber by the Redwood nearly equals that of the Douglas Fir.

On the banks of the Ogwen River, growing in alluvial deposit, this tree has risen to the height of 84 feet in twenty-nine years, the stems at the same time being bulky in proportion, and clean and smooth as a Norway spar. The timber is very good, and as the tree is one that is peculiarly suitable, from its rapid rate of growth, for planting with the Douglas Fir, I have every reason for believing that in suitable positions it will be a valuable forest tree in this country. Like the Douglas Fir, it will not succeed in high-lying and exposed sites, sheltered valleys and rich soil being more suitable to its particular wants.

(13) Lambert's Cypress (*Cupressus Lambertiana*) is a capital maritime tree, and its value in economic planting lies in affording a great amount of shelter where few other trees can succeed, and producing a clean and valuable timber.

(14) The Mount Atlas or African Cedar (*Cedrus atlantica*) has

several good qualities that recommend it as at least a third-rate tree for planting in our woods and parks. Better than almost any other Conifer I know, the Mount Atlas Cedar will grow on cold, stiff soils and where biting blasts are of frequent occurrence.

(15) *Pinus rigida* has been turned to good account on not a few estates in Britain, particularly for planting on exposed sandy tracts of land, where it affords a great amount of shelter to other less hardy kinds. The timber is of no particular value.

(16) Lawson's Cypress (*Cupressus Lawsoniana*).—I was agreeably surprised the other day to receive information from a Scottish landed proprietor that the Lawson's Cypress, when planted as a forest tree, had done well with him and produced a large quantity of excellent timber. On the Churchill estate, in the North of Ireland, this tree has certainly exceeded every expectation, the rate of growth being rapid and the timber of good quality. It requires a certain amount of shelter, fairly good soil, and plenty of room to develop its side-branches, the latter being the most serious drawback to it as a general forest tree.

Recapitulation.—Out of the two hundred and twenty-two species of coniferous trees that have been introduced to this country, the sixteen species just treated of are about the only kinds that I can, from my own experience, recommend for profitable planting in the British Isles, and it is very questionable if any others of equal merit can be added to the list. Nearly all the newer and rarer Conifers have been under my charge and planted by me in quantity, so that I have had ample opportunities in three of the most favourable situations in the British Isles for acquiring a good knowledge of their requirements and value whether for ornamental or profitable planting.

Some others, such as *Abies grandis* and *A. nobilis*, *Pinus insignis*, *Thuyopsis borealis*, and perhaps the Mammoth Tree (*Sequoia gigantea*), might, perhaps, have been included in my list; but, from my own and others' experience of these, they are not to be recommended, whether on the point of utility or hardihood, for general forest planting in almost any part of the British Isles.

THE DECORATIVE CHARACTER OF CONIFERS.

By Mr. EDMUND J. BAILLIE, F.L.S.

A GLANCE at the programme giving the titles of the papers to be read at this Conference shows how exhaustively the subject has been considered, and is set down for treatment, and it will be apparent how little room there is to stand upon where the ground is so thickly covered. In the title chosen for my few remarks it will be seen I am not to confine myself to the consideration of Conifers alone as Conifers—that is to say, to the consideration of the characteristics of Conifers, as separating them from other ornamental plants and separating them from each other, in their genera and species—but, rather, we are to look for a few minutes on this interesting and beautiful family of plants considered in combination with surroundings which are of a decorative character. We are to consider the decorative character of Conifers, and, in connection with this, the securing of decorative effects by their judicious introduction.

The decorative character of Conifers as a subject therefore includes the consideration of nature and art. The moment you bring in decoration you necessarily touch art. Indeed, from one point of view, you cannot touch the Conifers themselves, in the wider sense, without at the same time throwing yourself back upon that discerning and selective process which can only be described as art, and which has brought into Britain the progenitors of this now naturalised family, in its beautiful variation and diversity; for, with but very few exceptions, Conifers come under the classification tabulated “Introduced—not native.” Then, further, let us note, a chance seedling which comes up where the hand of Nature has laid it is the offspring of Nature, so to speak; but the moment you bring man upon the scene he looks about him and before him, and considers what the effect will be when the tree he is now placing here shall fill the place appointed for it. That is necessarily the introduction of art. But art in association with the ideas we are now considering has a wider range. The idea of culture in *any* of its departments, as applied to aspects of nature—say horticulture, agriculture, or arboriculture—brings us face to

face not with a phase of nature alone, but with a combination of art and nature in the various directions more or less indicated by the terms employed. Man in contact with nature thus quickly imposes conditions of art. For the introduction of the Coniferae into this country we are indebted, as I have just said, to the exercise of this art-faculty. Man has discerned the decorative value of the Conifers and has introduced them to Britain, and they are now not aliens, but so much parts of us that without them our decorative resources would be impoverished indeed. What a botanist regards and describes as natural distribution is the work of nature, but there it stops. Whenever man selects a place for a plant, or a plant for a place, he is then in the domain of art. He then is exercising the faculty of taste, and he is dealing with that which is to partake of the character we call decorative—though sometimes, through the exercise of a false judgment, through lack of good taste, it is quite the reverse.

This faculty of taste—call it æstheticism, sentiment, culture, what you will—is an endowment of the human soul. What we term fashion, either in flounces or flowers, either in garb or garden, in the furnishing of the parlour or in planting a park, introduces of necessity this exercise of taste. This displayed determines the status, so to speak, of the person responsible, and tells exactly to the discerning what his views may be on the at times vexed questions which come within range of the canons of “good taste.”

We are familiar with the ribbon border, the geometrical beds, the floral devices of the flower garden; the gay garters, the ribbons, mottoes and monograms which were in so many places such a conspicuous feature, say, in the Jubilee year. We have seen eagles or peacocks, or the semblance of such, at times cut out, or hacked out, of what would otherwise be an ornamental tree. We have looked upon the wild garden, the evergreen border, the wooded slope, the little bit of nature-weaving here and there, the beautiful single specimen tree in its proper place, and the delicately arranged group of Conifers standing out in the open which one is fortunate enough to find here and there. All these are in their respective places, and upon their several lines, indications of the application of principles dictated by individual taste.

The effects of combination of form and colour are considered

and thought out as an idea, almost unconsciously at times, but the taste-faculty acts and determines nevertheless, and the afterwards materialised fact constitutes the features of the landscape immediately about us. It has been pointed out that man's actions perpetually bring him out of concealment, and he is then discovered; so no man can plant a tree, or arrange a group, taking survey of the surroundings about him, without so far displaying the bent of his genius, the level of his culture, and the possession of taste.

There are few classes of plants in connection with the disposal and arrangement of which it is so needful to exercise care and judgment as the Coniferæ. They are so distinctively decorative, and so decoratively distinctive, that it is readily possible to make a thing of beauty with slender resources, or to mar a beautiful thing or a beautiful place, or both, by putting in plants of the wrong kinds in the wrong way in the wrong situations.

A Cedar within a few feet of a main walk, an *Araucaria* in the town garden where the space available was but a few yards and the branches were thrown out in provoking proximity to the drawing-room window, I have seen within the past few weeks, in each case an evidence of misjudgment, bad taste, and a perpetual eyesore to everybody.

The decorative character of Conifers is not confined to the few features which seem at first to constitute the characteristics which may be taken as forming the ornamental endowment of trees and plants which cannot be classed for decorative effect amongst flowering plants, as, though the Coniferæ come within the division *Phanerogamia*, their flowers are indistinct and nearly valueless as "ornament." If we think over what there is to be found in Conifers tending to make them conspicuously beautiful features, either singly or grouped, we should find how rich the family is in points of grace and dignity, of colour-glory, and in other features having, rightly, a claim to be classed amongst the beautiful.

Linnaeus spoke of the Palm-trees as "princes of vegetable nature." Whilst the Palm may claim this regal recognition in the tropics, surely the Pines are princes also. I think in the Gaelic tongue the Scotch Fir—so called, though really it should be the Scotch Pine, as it is strictly speaking a Pine and not a

Fir—the Scotch Fir, however, we will consider accurate enough for our reference—in the Highlands the tree is particularised by the title “King of the woods.” It is so. And what a right royal assemblage of kings does a Pine-wood present! A Pine-wood has a majesty and dignity quite its own. There is nothing else in the vegetable kingdom like it. Those stately shafts bearing splendidly balanced branches and crowned heads of dense deep foliage, standing back on the hillside, present a grandeur which cannot be surpassed by any other picture in the Book of Nature. Whilst there is the distinctive form so readily observable in the Pines, and whilst they command our attention, and secure our admiration, as they cover the mountain-side, or adorn the crag, or stretch away until, mingling with the purple haze of the horizon, lost in the indistinctness of the distance, there is an equally marked individuality about the Cedars, the Cypress, the Yew—all have their sharply defined characteristics which give variety of a quality which cannot, after all, be secured by deciduous trees, or even by evergreens outside the genus we have under present consideration.

But, in addition to this splendid diversity of form in the dignity of the mountain Pine, the stately grace of the Cedars, or the dense rounded symmetrical beauty suggested, rather than defined, by some of the smaller Coniferæ, there is an indescribable richness in the colour tints peculiar to this race. Here it is fitting to remind ourselves that Conifers are not dependent upon the gay glory of inflorescence for decorative qualities. They have no conspicuous flowers to attract, but they possess a wealth of colour-suggestiveness that captivates not merely by the delicate gradations which mark the passing of one shade into another, but many of the species possess a distinctive charm in a marvellously beautiful glaucous haze, equivalent to the bloom on carefully grown fruit, too ethereal almost to be defined as a character of the foliage, so delicate is it that it looks as though it is an attribute of the atmosphere rather than a possession of the plant itself. There is then the grace of the form of feathered plumes in the tenderness of the new foliage standing out distinct and clear against the denser background to which it is such a rich relief, but this background itself has its blendings of beautiful colour with the deeper shades where the sharp outlines of defined foliage are lost in the misty shadow, where the greens

have melted into liquid greys and neutral tints which the eye of the artist discerns everywhere pervading, save in the play of light upon those parts of the plant brought into relief and prominence.

If the Pines derive little interest, and no decorative effect, from inflorescence, they have a distinctive gain in their cones. The name of the genus is an indication of the fact that this is a feature which ought not to escape observation, and indeed it is an investiture that cannot fail to arrest attention just at this season. How splendidly studded are the branches of *Cedrus atlantica* with the soft purple-tinted tips standing up on the flat fields of foliage like mushrooms in the meadows of the fairies!

Take in your hand the symmetrical cone of *Pinus excelsa*, and see what a study it is in purples and greens. Cast your eye along the straight shaft of *Abies nobilis*, and see the great cones levelled along the branchlets high up, almost like the tubes of a telescope, directed some this way and some that, a marvel of construction, and filled with that most refreshing odour of balsam which is full of the spirit of the Firwood, and seems to waft suggestions of cleanliness and health—why I never could see, excepting that we seem to have the capacity for uniting certain experiences with certain odours and certain conditions which come within the range of one sense with certain facts suggested through the medium of another. And how can I attempt to describe the slender grace of the drooping branches of Larch? Some things by their simple grace and delicate harmony defy description. Nature then will not be brought within the limits of language.

The growth and habit of Conifers, again, necessarily enter largely into their decorative character. The Pines love the heights. They seem to have been made for the mountains. The Yew stands fittingly about the corners of God's acre. The lawn is graced by the sweep of the Cedars. The avenue would look all the tamer, and the poorer, but for its fringe of Austrian Pines, for the brighter green of the tender tasselled Larch, and for the erect presence of the sober Spruce.

What should we say of the Araucarias at Bicton, of the Golden Yews, the Junipers, the noble specimens in the Pineta of many of the notable grand ancestral homes of the English

The true beauty and decorative character of the larger Conifers can perhaps only rightly be seen just in proportion as the trees themselves are allowed their freedom for development in the open and in natural positions, but that is not the particular aspect in which I can, in a paper of this character, and within this limited scope, point out. The Conifer considered in relation to natural adornment is a captivating subject, but we must not be tempted to discuss it now. We must pass on all too rapidly. Time is inexorable. Next to this isolation in native and natural grandeur and stateliness I suppose we might place the Pinetum, which is one of the methods of art to present the nobility of the Coniferæ in the majesty of individual isolation, but in a certain order of classification or arrangement, to show, as far as can be shown under such conditions, the true aspect and character of each species, and to secure an artistic effect which shall at once be a permanent source of attraction, of instruction, and of ornamentation. Woburn, Chatsworth, Dropmore, Bickton, and many other places have this splendid additional attraction to the garden resources as ordinarily enjoyed, and it seems useless to attempt to indicate by written word what is the impression produced upon one by such noble collections of noble plants.

I had the privilege a few days ago of walking through the Pinetum at the Bache Hall, near Chester, the charming residence of Mrs. Hudson; and whilst the Wellingtonia, the Pines and the Firs were all beautiful, *Cedrus atlantica* with *Pinus excelsa* were so captivating as to make one throw aside the pen and the brush as unworthy media to describe these queens at home. And it is the same everywhere, whenever we find them thus enthroned in their stately dignity. I pass along a corridor of Conifers every morning in my walk through the Chester nurseries, and I am always captivated by the charm of the varied forms which blend so gracefully with the interwoven tints of green and gold.

The next decorative feature to which the Conifers readily lend themselves is the adornment of park or pleasure-grounds, where the trees stand out in less solitary grandeur than in the Pinetum; yet even here we have single specimens here and there and dotted about in groups—Firs, Cedars, and Pines, whilst Thuyas, Yews, and other resources are all brought into requisition for this purpose. Coming now into the closer and more confined quarters

of lawns and gardens proper, the difficulty of making observations is intensified, as other considerations come in for due attention. In addition to the lawn itself, there is the fringe about the lawn, which is, perhaps, the most permanently attractive feature of the ordinary suburban garden. Here, it seems to me, for sweep and curve, a border fairly closely planted mainly with Conifers (though I must make room for an Aucuba, with, say, a Silver Birch here and there) nothing could be made prettier. I regret I am not able in this brief paper to suggest varieties by name, yet I cannot refrain from mentioning such indispensable plants as *Juniperus chinensis*, *Retinospora squarrosa*, *Thuyopsis dolabrata*, *Cupressus Lawsoniana stricta* and variegated forms, *Retinospora filifera*, *Retinospora obtusa*, with the Red Cedar, the Irish Yew, the Chinese Yew, and the Golden Yew. But having once permitted myself and committed myself to names, how shall I stop?

These should be so arranged as to give that charm of variety in form and colour which can be so well secured by this means. The deep glaucous green of some of the Cupressus, notably, say, *stricta* or, better, *Alumii*, the deep heavy green of the Yews, the fluffy prettiness of *Retinospora squarrosa*, relieved with the rich golden glory of foliage for which some of the better variegated forms of the Cupressus and the Yews are conspicuous—these, with a background of the taller Cypresses and with here and there a straight-stemmed plant of *Pinus excelsa* and *Pinus Cembra* kept within bounds, leave little to be desired in the way of effective decoration in the form of a dense screen and shelter, which is a thing of beauty and a joy for ever. In the early spring and in the late autumn there is an indescribable freshness and brightness about a border of Conifers of this character which must be seen to be realised, for it cannot be described.

Terraces and garden-beds may come in for consideration here also, and I have always thought that there is ample room for the freer introduction of Conifers for the purely ornamental portion of the garden. We have scarcely gone any distance in this direction, but wonderful effects are within reach, and these would add real effectiveness to the brilliant beds and borders hot with Geraniums and Petunias and Verbenas, and glowing with the gold so profuse in the Lady-purses—the flowers of the gay Calceolaria. It would be quite possible to invent a relief to this

perpetual repetition by a judicious introduction of an arrangement in quieter tone, a harmony in green and gold, or, shall we say, a nocturne in bronze and silver?

If, despite Mr. Ruskin, Mr. Whistler can command a following of admirers, and show in those fancifully named productions works of art and the creation of genius, and produce points to admire in the subdued tones of browns and greys, may we not put on the canvas laid out before us not strokes and patterns of gay-coloured brightness alone, but here and there some bold outline in those matchless shades of green, some pretty design which will appeal by contrast, and will not seek to offer itself in competition with the dazzle and glitter—which, mark, is in no way condemned, but may be beautiful, often is gloriously beautiful—to the ribbon border, or the geometrical garden, or the other forms and devices which are to be found within the walls, or the hedges, of the flower-garden proper?

If the notion is too heterodox for ready acceptance, might it not be urged that a trial might be made for the winter flower-garden, and for a bed or a corner in the spring garden before the burst of summer brings its wealth of flowers and its festoons of foliage? I saw a few days ago such a bed as I have in my mind's eye, a bed say ten feet by five, cut out like a panel, upon a rich sward of velvet green; the bed was edged with close-growing plants of *Juniperus prostrata*, growing each way, that is reversed in the planting, thus securing growth one into the other. The bed contained thirty plants in all, including *Retinospora pisiifera lutescens*, *obtusa alba*, *tetragona aurea* and *squarrosa*, *Cupressus Lawsoniana alba* var. and *argentea*, and a few plants of upright dense Irish Yews. None of the plants exceeded eighteen inches to two feet in height, and others were barely a foot high, but they were graded and arranged as effectively as seemed possible, and produced an effect which the glory of the adjoining border, rich with the autumn wealth of Sunflower, Phlox and Gladioli, could not hurt; it had a quiet impressiveness all its own, and when the eye grew tired of the red and the gold and the shades of purples and pinks in the herbaceous border, it travelled back to this beautiful bed which illustrated, powerfully, in one direction, the decorative character of Conifers.

I have not touched upon many other points which suggest themselves, such as the place Conifers may take in the planting

of avenues, of hedges, of screens for shelter, in the rock garden, about the margins of lakes, on slopes within eye range of the dwelling, where beautiful distant effects may be got, or for memorial trees to stand in closer proximity to the house, to mark in the memory some event with which the planting of the tree has been linked. Conifers might be considered, too, in relation to town gardens, and for the window boxes where even the town garden is not possible. I am quite aware of the fatal effect of smoke and the heavy atmosphere of cities and centres of dense population, yet in the possession of the knowledge that a few months would probably mark the life-limit, at any rate for decorative purposes, of some of the better kinds, I would advocate a freer use of Conifers for situations and conditions even such as these, for I am an earnest advocate for the introduction of plant-life in all available forms, especially the prettiest, about the homes of the people everywhere.

I have, however, come to the limit of my time and feel I have only touched the fringe, and that but feebly and poorly, of a subject wide, interesting, and familiar, for we are familiar with the Pines and the Conifers generally. So common are they that they are about us everywhere. Upon some of the more peculiar types, such as the *Araucaria* and *Salisburia*, I have not spoken, and yet upon these and upon all there is so much to say. I am always thankful that these beautiful evergreen types of stateliness of form and splendour of foliage both in character and colour are so abundant and common on every side, and I feel inclined to bring my remarks to a close with the words of Evelyn in his "*Silva*"—that splendid old English classic with which I hope we are also familiar. Having discussed in his wonderful way over the wide field brought before him, he concludes, as I shall ask to be allowed to conclude, thus: "But a wise and thinking man can need none of these topics; everywhere they are before him; and yet we do not admire them sufficiently because they are common and obvious: thus we fall into the just reproach given by one of the philosophers to those who slighted what they saw every day, because they every day saw them. As if novelty only should be of more force to engage our enquiry into the causes of things than the worth and magnitude of the things themselves."

CONIFERS AT DROPMORE.

By Mr. CHARLES HERRIN.

IN the following short paper I have been requested to communicate to the Conference notes on the present condition of the Conifers at Dropmore, with a list of the more important ones, their present height and girth, and, as far as possible, their date of planting.

Before giving any description of the condition of the trees, I may say the general character of the soil is of a light and gravelly nature, and such as American plants grow freely in, the substratum consisting of gravel and sand, into which the trees root freely. Visitors to Dropmore generally suppose that the soil must be exceedingly rich and good, but it certainly is not, although many of the trees have in the past been occasionally top-dressed with a heavy clayey loam, and any soil or refuse likely to decay is carted away and spread about the roots of the trees. Undoubtedly the top-dressing, especially that of a clayey nature, has very materially benefited them, both by keeping the roots in a moist condition and as a rooting medium, for wherever heaps have remained under Cedars and other trees the roots have worked up freely into it.

In taking the present condition of the Conifers into consideration, they are, speaking generally, in a flourishing condition and growing freely, the majority showing no signs of old age or stunted growth. There are some exceptions among the Pines, a few of which have apparently passed the prime of life, although they are really beautiful in their rugged and weird state, and for this reason form pleasing features among other trees. This remark applies to *Pinus macrocarpa*, planted in 1835, the seed of which came from the Royal Horticultural Society's gardens at Chiswick; also *P. pungens* and *P. rigida*, each of which is about 70 feet high, with many branches. Trees of the Silver Abies (*A. amabilis*) are also exceptions, and of late years have deteriorated very much, having no leaders, and the upper branches are partially dead and covered with lichen. One tree, the largest, is 48 feet high, and was raised from a cutting and planted in 1847. The original tree, planted in 1835, is but 35 feet in

height, and was probably a grafted plant. The lower branches of these trees are quite healthy and sweep the ground.

Perhaps the two most remarkable trees at Dropmore are the large *Abies Douglasii* and the *Araucaria imbricata*, both kinds of trees growing very freely. It may be interesting to give a few particulars respecting them. The monarch Douglas Fir, planted in 1830, has attained a height of 120 feet, girth of trunk 11 feet 9 inches, with beautiful spreading branches sweeping the ground, covering a diameter of 64 feet. The leaves are also of a glaucous hue, equalling in that respect many of the plants now sold from nurseries under the name of *Douglasii glauca*. Snowstorms have, unfortunately, broken down several of the upper branches, but the vigorous growth the tree has made the past few years is fast repairing the damage done by snow, young growths of the present season varying from 12 to 21 inches in length. Rubbish, weeds, and soil refuse are continually being wheeled under this tree and spread to decay, which has no doubt produced very beneficial effects. The seed that produced this tree was sent by the Horticultural Society to Lord Grenville in December 1827, and raised, and planted out here in 1830. Many trees have since been raised from its seeds and planted out on the estate; one, planted in 1843, is now 78 feet high, with a girth of trunk of 8 feet 2 inches, spreading 39 feet in diameter at base—a perfect specimen.

Although the *Araucaria* is considered by many to be a formal and heavy-looking tree, it must be conceded that a fine specimen has a grand and imposing appearance. The largest tree here is now 68 feet 6 inches in height, with abundant and vigorous growth, very healthy branches sweeping the ground, spreading 38 feet in diameter. It is a male tree and annually produces numbers of pollen-bearing catkins. No doubt the position in which the tree is planted suits the requirements of the *Araucaria* admirably. It is 60 feet from the edge of a piece of ornamental water with a gentle slope of about 7 feet from the tree to the water's edge. The spot whereon the tree stands was once a gravel pit which was filled up when the lake close by was made. Consequently it enjoys a good depth of soil and perfect drainage, with fairly moist surroundings. It is occasionally top-dressed with a little clayey loam. This tree is supposed to have been purchased at a sale in the Chiswick Gardens in the year 1829,

and was one of four *Araucarias* planted here in 1830. The other three trees have each produced perfect seeds, but are smaller, the highest being not more than 50 feet. As far as I have been able to distinguish, all the trees bearing pollen catkins are of more robust growth than those producing fertile cones. This has certainly been so at Dropmore during the past three or four years. In a group of *Araucarias* planted in 1842 the largest is a male tree 50 feet high, 12 feet above either of the others planted at the same time. One of these produced thirty fertile cones this year.

The Cedars also form a notable feature at Dropmore. An avenue numbering 140 trees of *Cedrus Libani*, planted about eighty years ago, average 85 feet in height with a girth of $7\frac{1}{2}$ feet. One of the first coniferous trees planted on the estate was a Cedar of Lebanon near the house. This tree, planted by Lord Grenville in 1792, is now 104 feet high, with a girth of 13 feet 9 inches at three feet from the ground. The Cedars seen on driving up the carriage approach to the house from the Taplow entrance are very striking; they have an imposing appearance, and aptly illustrate the effective use of these trees for ornamental planting, especially in large places. Many of the Lebanon Cedars partake much of the *atlantica* arrangement of branches, the points erect; several are also very glaucous.

A very handsome tree is *Cedrus Libani argentea*—in the sunshine almost like a sheet of silver—and a worthy companion for *C. atlantica*; indeed it is rather difficult to detect any great difference in the species; the only one perceptible is that the points of the branches are less erect in the former than are those of *C. atlantica*. There is also a structural difference in the cones of the two trees. The tree here of *C. L. argentea* is 84 feet in height, with a girth of 10 feet. *Cedrus atlantica*, planted in 1843, is a perfect specimen, 64 feet high, girth of trunk 5 feet 10 inches.

Many specimens of *Cedrus Deodara* have attained a height of from 60 to 70 feet, and are full of health and vigour. One, planted in 1840, stands 72 feet high, girth 9 feet 9 inches, the diameter of branches 47 feet; another tree, planted earlier (in 1834), is 65 feet, girth 8 feet 9 inches. A cutting from this tree was struck and planted in 1843, but the tree has made a very poor specimen, scarcely 50 feet high, the branches very short

and thinly disposed. Another, planted in 1838, inarched on the Larch, has made a better tree, although not equal to others raised from seed some years later. It is recorded that the largest Deodar here was destroyed by lightning in 1881; it was supposed to be the largest tree of the kind in the kingdom. Near the ground the trunk was 12 feet 3 inches in circumference, and good boards 38 inches in width were cut from it. This tree was raised from seed given to Lord Grenville by the Hon. Leslie Melville in 1831, who brought the cones from India.

Among the Pines, *Pinus insignis* is deserving of a few remarks. Here it is but seldom that this noble Pine is injured by frost, or if so, but slightly. During the past winter of 1890-91 a few of the terminal shoots of the lower branches were killed. There are two good specimens. One, planted in the year 1839, is 90 feet high with a girth of 11 feet; another, planted the same year, is 79 feet high, trunk 12 feet 10 inches in circumference. It is on record that this tree, when only half an inch high, was a present from Mr. Munro, chief gardener at Chiswick, and that my predecessor, the late Mr. Frost, brought it home here in his waistcoat pocket. *Pinus Laricio*, "the Corsican Pine," planted in 1829, has attained a height of 94 feet, with a fine clean bole; girth, 9 feet. Another, also planted the same year, girths 9 feet 9 inches, and several others are of nearly equal proportions.

The following list includes many of the best trees, with their heights and girths and date of planting (girth taken 3 feet from ground):—

Abies Douglasii, planted 1830. Height, 120 feet; girth of trunk, 11 feet 4 inches; spread of branches, 64 feet diameter on ground.

Abies Douglasii, planted 1843. Height, 78 feet; girth, 8 feet 2 inches; spread of branches, 39 feet.

Abies Albertiana, planted 1861. Height, 58 feet; girth, 5 feet 3 inches. A very handsome tree, of pyramidal habit, the branches gracefully disposed, and spreading 40 feet in diameter at base.

Abies grandis, planted 1861. Height, 64 feet; girth, 6 feet; spread of branches, 35 feet in diameter on ground. A very fine tree.

Abies amabilis, planted 1847. Height, 48 feet 6 inches; girth, 6 feet 6 inches.

Abies Pinsapo, planted 1843. Height, 65 feet; girth, 6 feet 10 inches; diameter of branches at base, 31 feet.

Abies Pinsapo, planted 1843. Height, 63 feet.

Abies Pindrow, planted 1843. Height, 27 feet. Young growths frequently injured by spring frosts.

Abies Brunoniana, planted 1847. Height, 41 feet; circumference of branches, 134 feet. A spreading, bushy tree.

Abies nobilis, planted 1835. Height, 71 feet; girth, 7 feet 9 inches. Healthy branches to the ground.

Abies pectinata. Height, 94 feet; girth, 8 feet 6 inches.

Abies concolor, planted 1857. Height, 51 feet; girth, 5 feet 3 inches. A handsome tree.

Abies Smithiana, planted 1843. Height, 61 feet; girth, 7 feet; spread of branches, 38 feet in diameter. A beautiful tree.

Abies Smithiana, planted 1843. Height, 51 feet; girth, 5 feet 10 inches.

Abies cephalonica, planted 1843. Height, 71 feet; girth, 7 feet. A fine tree.

Abies Menziesii, planted 1841. Height, 73 feet; girth, 8 feet 2 inches.

Abies Menziesii, another specimen, planted 1841. Height, 61 feet; girth, 8 feet.

Araucaria imbricata, planted 1830. Height, 68 feet 6 inches; girth, 8 feet 3 inches; spread of branches, 38 feet in diameter, sweeping the ground.

Araucaria imbricata, no date. Height, 61 feet; girth, 6 feet 10 inches.

Araucaria imbricata, planted 1842. Height, 50 feet; girth, 5 feet.

Araucaria imbricata, planted 1830. Height, 50 feet; girth, 5 feet.

Cedrus Libani, planted 1792. Height, 104 feet; girth, 13 feet 9 inches.

Cedrus Libani, no date. Height, 87 feet; girth, 12 feet 4 inches.

Cedrus Libani argentea, no date. Height, 84 feet; girth, 10 feet. A beautiful tree.

Cedrus atlantica, planted 1843. Height, 64 feet; girth, 5 feet 10 inches. A very handsome tree.

Cedrus Deodara, planted 1834. Height, 65 feet; girth, 8 feet 9 inches.

Cedrus Deodara, planted 1840. Height, 72 feet; girth, 9 feet 9 inches; diameter of branches, 47 feet.

Cedrus Deodara, planted 1840. Height, 67 feet; girth, 8 feet 3 inches.

Cryptomeria Lobbi, planted 1843. Height, 52 feet.

Cunninghamia sinensis, no date. Height, 39 feet; girth, 4 feet 10 inches. Some branches die annually.

Sequoia sempervirens, planted 1845. Height, 73 feet 6 inches; girth, 10 feet. A handsome tree, with graceful branches to the ground.

Pinus Benthamiana, planted 1843. Height, 56 feet; girth, 6 feet 3 inches. One of the handsomest Pines here.

Pinus Jeffreyi, no date. Height, 47 feet; girth, 4 feet 6 inches.

Pinus insignis, planted 1839. Height, 90 feet; girth, 11 feet 1 inch.

Pinus insignis, planted 1839. Height, 79 feet; girth, 12 feet 10 inches.

Pinus Pallasiana, no date. Height, 96 feet; girth, 11 feet.

Pinus Laricio, planted 1829. Height, 94 feet; girth, 9 feet. A fine clean bole.

Pinus Laricio, another tree, planted 1829. Height, 96 feet; girth, 9 feet 9 inches

Pinus ponderosa, planted 1829. Height, 85 feet; girth, 8 feet 9 inches.

Pinus pyrenaica, no date. Height, 86 feet; girth, 9 feet.

Pinus Lambertiana, planted 1843. Height, 71 feet; girth, 8 feet 8 inches. A fine tree.

Wellingtonia gigantea, planted 1857. Height, 67 feet; girth, 11 feet 3 inches. A fine tree.

Wellingtonia gigantea, another tree, planted 1862. Height, 62 feet; girth, 12 feet.

Thuja gigantea, no date. Height, 62 feet; girth, 6 feet 6 inches.

CONIFERS AT ORTON LONGUEVILLE.

By Mr. A. HARDING.

As the Royal Horticultural Society, in promoting this Conference on Cone-bearing Trees and Shrubs, is desirous of information respecting such plants grown in this country, a few remarks on the collection grown at Orton Longueville may not be unacceptable.

The late Marquis of Huntly was a great lover of trees, Conifers being especial favourites, and my present noble employer, the Dowager Marchioness of Huntly, is quite as enthusiastic in her love for trees, as also of all other kinds of plants, and to her ladyship I am greatly indebted for much useful information as to when many of the fine trees here were planted. They have been under my own observation for the last fourteen years, and some of them have made great strides as to height and girth during that time. The soil seems suitable for most kinds; nevertheless, a few of them do not thrive well, notably *Araucaria imbricata*, or the Chili Pine, and the handsome Silver Fir, *Abies nobilis*. The soil is a fertile loam resting on gravel, in some places 3 or 4 feet deep, in others not so much. According to the Ordnance Survey, the altitude above sea-level is about 55 feet, and the rainfall averages between 24 and 30 inches.

Foremost among the Coniferæ here stands the Wellingtonia, or Mammoth Tree of California, upwards of 300 specimens being planted in various parts of the grounds, ranging from 45 to 70 feet in height. The Wellingtonia avenue is 36 feet in width, with a gravel drive 12 feet wide up the centre, the trees being planted 30 feet apart on each side. The length of the avenue in a straight line is 700 yards, containing about 140 trees—all of which were raised in the gardens from seed or cuttings (the majority of them from seed) when first introduced, and the first and best batch of young plants were planted in this avenue about the year 1859. Those raised from seed now show a marked difference from those obtained from cuttings. Many of the former are fine symmetrical trees with good leaders, and about 70 feet high, while those raised from cuttings do not grow so freely, and have besides a tendency to form many leaders. The girth of some of the largest at a foot from the ground is 15 feet. A few have been cut down, but the timber does not appear to be of good

quality ; it is coarse-grained and spongy-looking, and not at all easy for the cross-cut saw to work through.

Of the Silver Firs there are some good specimens. *Abies Pinsapo*, the Spanish Silver Fir, is a fine tree 60 feet high and 7 feet in girth. *A. Nordmanniana*, 58 feet high and 5 feet 6 inches in girth, a handsome specimen, produces cones freely and some fertile seed. *A. amabilis*, 38 feet high, with 4 feet 6 inches girth. This tree has beautiful foliage, more dense and silvery beneath than Nordmann's Silver Fir. *A. Morinda*, the Indian Spruce, is 53 feet high, 5 feet in girth, and is quite a distinct species, having a weeping habit. *A. Douglasii* is 65 feet in height, with a girth of 8 feet. This has lost its leader, owing to rooks and other birds resting upon it. There are other young trees of it growing well in a damp and rather shaded situation. *Abies lasiocarpa* is 60 feet high, with a girth of 8 feet 9 inches, and has increased 6 feet in height and a foot in girth since May 1888. This is one of the handsomest trees in the collection ; it has dense horizontal well-feathered branches reaching to the ground. Three years ago it produced a quantity of cones, but this year only two or three, and these are unattainable without damaging the tree. *A. cephalonica*, the Greek Silver Fir, is between 60 and 70 feet high, with a large spreading head and good trunk. It has produced fine cones this year.* It is growing in a damp situation with a northerly aspect. *A. grandis* is a fast-growing tree, some seasons making 3 or 4 feet leaders. The tallest specimen is 65 feet high, with a girth of 7 feet. The common Spruce, *A. (=Picea) excelsa*, is represented by several good specimens, one of the best of which is 69 feet high, with a good trunk. *A. nobilis*, as already stated, does not thrive well here, the best being only 35 feet high, and is also of poor habit. *A. magnifica* is distinct and beautiful, but there is only one young specimen about 20 feet high. It, however, produced seven or eight handsome cones three years ago. *A. bracteata*, measured recently, is 50 feet high, and promises to form a good tree. It has not, so far as I have observed, produced any of its remarkable cones yet. *A. amabilis* produced one solitary cone two years ago, but, unfortunately, I failed to save it. In May its bright red-coloured catkins produce a telling effect against its

* Some cones of this species were exhibited at the Conference, and were very beautiful.—Eds.

dark green foliage. The best of the common Silver Firs, *A. pectinata*, is 85 feet in height and 13 feet 6 inches in girth.

The genus *Pinus* is represented by some tall handsome trees. *P. Jeffreyi* is not yet a very large tree, but produces fine cones. *P. excelsa*, the Bhotan Pine, should find a place in every garden of any size, owing to its distinct and beautiful appearance. The tallest tree is 61 feet high, with a girth of 10 feet. *P. Sabiniana* is 55 feet high and 7 feet 9 inches in girth. *P. macrocarpa* has long drooping foliage a foot in length. The cones, although at present produced but sparingly, are remarkable for their size—the largest are 9 inches in length and 18 inches in circumference. The tree is 55 feet high, with a girth of 8 feet. There are several trees of the heavy-wooded Pine, *P. ponderosa*, the tallest of which is 63 feet, and 6 feet in girth. It has a columnar appearance, like the Italian Poplar. *P. Laricio*, or Corsican Pine, grows freely and makes a good head; it also produces whorls of cones profusely. The tallest tree is 60 feet, with a girth of 7 feet. *P. austriaca* is 45 feet high, and forms a dense head of foliage. It is good for shelter. Among others are *P. monticola* and *P. muricata*, Bishop's Pine, with whorls of cones of several years' growth. It has a very distinct dwarf habit, being only about 20 feet high, although it is as old as some that have a height of 60 feet. The Weymouth Pine, *P. Strobus*, and a few others are also represented.

The three kinds of *Cedrus* are represented by good specimens, the handsomest of which, in my opinion, is *C. atlantica*, or Mount Atlas Cedar of Northern Africa. It produces cones in abundance, and throughout the summer and autumn months its glaucous foliage and hundreds of cones have a very telling effect. It is over 60 feet high, with a girth of 8 feet 6 inches. *C. Deodara* is 46 feet high, and has a trunk 8 feet in circumference. It has not yet produced any cones, but plenty of pollen-bearing catkins. *C. Libani*, or Cedar of Lebanon, rises to 60 feet high—has good trunks, bears cones abundantly, and this year myriads of catkins also.

Of the Incense Cedar, *Libocedrus decurrens*, there are several trees, the tallest of which is 50 feet, with as symmetrical columns as one could wish; it thrives remarkably well, is about thirty years old, and produces curious little cones. This species was sold, and perhaps is now known by some, under the name of *Thuya*

gigantea, which, according to recent authorities, is quite another kind of tree altogether. *Taxodium distichum*, the Deciduous Cypress, is growing freely near water; and another deciduous Conifer, the Maidenhair tree of Japan, *Ginkgo biloba* (*Salisburia adiantifolia*), is 35 feet high, with a girth of 4 feet. This is growing in a drier situation and shallow soil. *Cupressus macrocarpa*, which is represented by about forty specimens—some of them rising to a height of 60 feet—has not proved itself quite hardy, twenty degrees of frost injuring the foliage, and the winter of 1860 killed some, as did also the recent severe winter of 1890. There are two distinct forms of it, but the foliage and fruit are similar. Their habit is different, one being upright or fastigiate, the other having more horizontal and spreading branches. *Cupressus Lawsoniana* grows freely, and produces good seeds in abundance. Several trees are about 40 feet high, and one has a trunk 5 feet 9 inches in circumference. The Redwood tree of California, *Taxodium sempervirens*, has a trunk 18 feet round, and is 68 feet high. Its cones, though much smaller, are very similar to those of the Wellingtonia, thus showing the two genera to be closely allied. The bark also bears a strong resemblance. There is a marked difference, however, in the timber, for while the Wellingtonia appears coarse and of bad quality, the Redwood has a close fine grain, and appears to be durable. A tree of it was cut down eight or nine years ago, and, although exposed to all weathers, appears now to be none the worse. The common Yew and the Irish Yew, *Taxus fastigiata*, flourish well; there is a good tree of the latter, very much resembling the Florence Court Yew. One of the most curious of the Taxads is the Fœtid Yew, *Torreya Myristica*, a tree, or rather a bush, about 20 feet high, and having a spread of branches of about 60 feet. It produces its singular fruit annually, in greater abundance some years than others; but throughout the summer months it has the appearance of a bush laden with green plums. They are about the size of, and have also a husk or outer covering enclosing a solitary seed like the walnut. The fruits usually drop off in October, and the outer covering, if bruised, emits a very offensive odour. About ninety per cent. of the seeds grown from this tree have proved to be good. The plant should be in every collection of Conifers, if only for curiosity.

Retinospora, but there is a good plant of the Whipcord Thuya, *T. plicata*, also *Cupressus sempervirens*, *Juniperus chinensis*, and *J. excelsa stricta*. *Thuja gigantea* is represented by many specimens rising 60 feet high, and thrives well. It has trunks as straight as a gun-barrel, and seeds freely. Young plants germinate in the gravel paths and other places; one even sprouted up on a large stone covered with damp moss and liverwort, and has grown 10 feet high in as many years. I raised young trees from seed twelve years ago, and many of them are now 25 feet high. A healthy tree will, in one season, make leaders of 3 and 4 feet. The foliage is good for decorative purposes, and as an ornamental hedge it stands clipping well, but this operation should be performed in March or April.

Some of the trees above alluded to were planted before 1844, such as the *Cedrus Libani*, *C. Deodara*, *C. atlantica*, *Pseudotsuga Douglasii*, *Pinus macrocarpa*, *P. Sabiniana*, *P. excelsa*, and a few others; but most of them were planted in the fifties and sixties. It should be stated that all the girths stated above were taken at about a foot from the ground. The altitude was taken by a tree-measurer on correct geometric principles.

Before closing these few remarks on the Coniferæ at Orton, there is one thing I wish to add as to the culture and well-being of these trees, and that is, never dig beneath them so as to mutilate their roots. I have found out from observation that the majority of them have active feeding roots near the surface, and although some kinds of trees and shrubs would not suffer much, established trees of the Conifer family suffer considerably. By all means, cut or hook out coarse weeds, but let the foliage that falls from the trees remain. In their forest state it is their own natural food and protection for the roots. As a matter of course, on lawns where trees have lost their bottom branches, and close turf grows up to the trunks, the leaves cannot be suffered to remain, for the sake of tidiness; but there are a large number of species that remain feathered to the ground for many years, and their leaves may be raked or put under these branches as food for the roots; and if time and material be at hand, a 3-inch covering of ordinary garden soil placed over this dead foliage would greatly benefit them, not only as more nourishment, but the extra weight of material on the surface acts as a preventive of the trees being blown over by strong gales

CONIFER CONFERENCE.

OCTOBER 8, 1891 (Second Day).

OPENING ADDRESS.

By Mr. W. T. THISELTON DYER, C.M.G., F.R.S., &c.

IN the absence of Professor Isaac Bayley Balfour, who was suffering from ill health, Mr. W. T. Thiselton Dyer, C.M.G., was moved to the chair. He expressed his regret that Professor Balfour was unable to be present, and he read a telegram from that gentleman, then in Carlsbad, wishing the Conference every success. Mr. Thiselton Dyer thought there could be no doubt whatever as to the success of the Conference, and it was largely due to the energy of Professor Balfour and his friends from Scotland. A glance at the splendid exhibition proved that it had been possible to get together a most complete collection of coniferous plants grown in the British Islands.

Anyone who had not travelled in Scotland could form no idea of the extent to which rare Conifers were cultivated in that country, and the splendid development which they attained. The Chairman, by way of illustrating these remarks, directed the attention of the audience to some large photographs representing specimens of Coniferæ to be seen at Murthly Castle in Perthshire, where they flourished, and where stately and magnificent examples, 70, 80, and 100 feet high, were to be met with. Such trees could only be seen in Scotland, and were the result of a peculiar association of physical conditions. In the south-west of England it was impossible to find a parallel, although even on the sun-burnt soil of Kew good specimens of the Pines proper were occasionally to be seen. With regard to the Abies, however—that section of Conifers of which the Spruces may be taken as a type—a state of things prevailed in Scotland which could not be rivalled in England. On the other hand, the climate in the south-west

of the latter country was fairly suitable for some other Conifers, and many of the fine Mexican Pines could be grown there.

The Chairman said he would not occupy the meeting with further remarks, as he had taken the chair at very short notice, and was quite unprepared for any formal address. He therefore asked the attention of the audience to Mr. Malcolm Dunn's paper, especially as that gentleman had displayed great energy in promoting the success of the Conference.

THE VALUE IN THE BRITISH ISLANDS OF INTRODUCED CONIFERS.

By Mr. MALCOLM DUNN, F.R.H.S.

THE subject which has been assigned to me at this important Conference—"The Value in the British Islands of Introduced Conifers"—is a deeply interesting one to all concerned in the management of our forests and woodlands, the beautifying of the landscape, or the amenity and prosperity of the country. Year by year the forests and woodlands in this country are becoming a more important factor in the amount of revenue derived from the land; and as time rolls by, with its fluctuations in commercial and rural prosperity, landowners are eager to adopt any reasonable method by which their property may be improved and its value permanently enhanced. From the dweller in the stately mansion of the wealthy to the inhabitant of the lowly cottage with its small garden plot, all are anxious to adorn their places of abode and make them more beautiful and attractive. For this purpose the treasures of the vegetable kingdom have been ransacked throughout the civilised world, and often beyond it, in the anxiety to secure the best and most beautiful of hardy trees and shrubs for shelter and decoration.

In carrying out these two leading objects—the *economic* and the *æsthetic*—exotic Conifers have played an important part, and more particularly during the century which is nearing its close. A little less than seventy years ago the Royal Horticultural Society nobly led the van, when it despatched the intrepid David

Douglas in 1824 to explore the sylvan riches of the North-west American coasts, from whence he was the means of introducing, through the Society, many of the stateliest and most beautiful Conifers which now adorn the British landscape and add interest and profit to our woodlands, foremost among which may be placed that valuable forest and ornamental tree, the Douglas Fir (*Abies Douglasii*), which so worthily commemorates his name. Others have followed in the footsteps of Douglas during a long succession of years, until scarcely a corner of that extensive and richly wooded region is left unexplored or unknown to the eager search and keen eye of the plant-collector. Among others who have been engaged in the introduction of the trees and shrubs of North-west America since the time of Douglas, probably the two most worthy of mention are William Lobb and John Jeffrey. Arriving in California in 1849, Lobb explored the forest regions of that and the adjoining states as far north as the lower Columbia River; and, through Messrs. Veitch & Son, of Exeter and Chelsea, whose agent he was, he introduced to Britain quite a host of useful and beautiful Conifers, among which the Mammoth Tree of California (*Wellingtonia gigantea*), introduced by him in 1853, is a substantial and, let us hope, a never-dying record of energy and enterprise rarely equalled. In the following year (1850) Jeffrey was sent out from Edinburgh, by the Scottish Oregon Association, to explore the forests of British Columbia and Oregon; and on arriving in the country in 1851 he immediately began, with characteristic energy and enthusiasm, the collection and despatch to Edinburgh of the many grand Conifers which it was his good fortune to introduce. Among them may be specially mentioned *Abies Albertiana*, *A. magnifica*, *Thuja gigantea*, and *Pinus Jeffreyi*, the latter of which commemorates his name.

While North America was thus being searched from end to end for new Conifers, other parts of the world were not neglected, although, till the opening up of Japan to travellers and explorers about thirty years ago, no really valuable additions were made from those parts to our list of hardy Conifers.

In Eastern as in Western exploration and search for hardy trees and shrubs the Royal Horticultural Society was among the pioneers, who, with praiseworthy zeal and resolution, determined to introduce to Britain at the earliest opportunity the sylvan wealth of temperate Eastern climes. In 1842 the Society sent

out Robert Fortune to explore the recently opened-up regions of the Chinese Empire, and from thence were acquired most of the coniferous trees and shrubs indigenous to the then accessible parts of that extensive country. Comparatively few of these have proved hardy, or sufficiently so to be valuable for cultivation in this country, and it was not till he visited Japan in 1860 that he was the means of introducing many rare and beautiful varieties of hardy Conifers which now occupy prominent positions in every demesne and garden of any pretension in this country. The last of the great names connected with the search for and the introduction to Britain of useful and beautiful Conifers which space will permit me to mention is that of John Gould Veitch, an enthusiastic and energetic member of a well-known firm of enterprising nurserymen who have done more than most people in their day to introduce hardy Conifers from all the known parts of the earth, and to encourage a taste for their cultivation in Britain. Mr. Veitch arrived in Japan in 1860, soon after that country was opened to Western nations, and by his indefatigable perseverance, tact, and skill was enabled to collect and transmit home many rare and beautiful Conifers, some of which were entirely new to this country, and even to science. Although a generation has not yet elapsed since these extremely useful and ornamental trees found a place in our gardens and woodlands, their refreshing appearance and healthy progress give promise of enduring beauty in our ornamental grounds, as well as of permanent value in our woodlands, in the ages to come.

In estimating the value of exotic Conifers, my scope has been judiciously limited by the Secretary of the Society to those which have been introduced to the British Islands during the past hundred years, more or less, for the satisfactory reason that the value of previous introductions is perfectly well known, and their merits fully appreciated. This limit excludes such valuable exotics as the Larch (*Larix europæa*), the Norway Spruce (*Abies excelsa*), and the Silver Fir (*Abies pectinata*), as well as several fine ornamental coniferous trees and shrubs, of which the Cedar of Lebanon (*Cedrus Libani*) is a notable example. The two main points to be kept in view in determining the merits and weighing the value of the newer Conifers in Britain are, *first*, their economic value as timber-producing trees, adapted for forest planting, for commercial and industrial purposes; and

second, their æsthetic value, as trees and shrubs of healthy growth, graceful habit, and attractive appearance, suitable for adorning the landscape and other purposes of embellishment. Keeping these points before us, our subject naturally divides itself into two sections—(1) Conifers as Forest Trees, and (2) Conifers as Ornamental Trees and Shrubs.

I.—CONIFERS AS FOREST TREES.

When beginning life as a gardener, in the middle of the “fifties,” my lot was cast in Perthshire, the county *par excellence* in Scotland at that period famed for the formation of collections of Conifers in Pineta, and where the new Coniferæ were being freely planted in the policies and woodlands on many an estate throughout the district. The excellent work and foresight of those days is now seen in the numerous collections of well-grown Conifers which so thickly stud the wide straths and well-wooded glens and hill-sides of that extensive county. Among the earliest planters in the county of the new Conifers may be mentioned the Earl of Mansfield, at Scone; Sir William Stewart, Bart., at Murthly; Sir Robert Menzies, Bart., at Castle Menzies; Sir William Stirling, Bart., at Keir; Lord Justice Patton, at The Cairnies; the Duke of Athole, at Dunkeld; the Earl of Kinnoull, at Dupplin; the Marquis of Breadalbane, at Taymouth; Lord Kinnaird, at Rossie Priory; Sir William Keith Murray, Bart., at Ochertyne; and many other owners of estates in the district, who planted on their demesnes more or less of all the new Conifers then supposed to be hardy in this country. In all instances where the Conifers were planted with care, and in suitable soil, the hardy species have generally thriven with a vigour which can scarcely be surpassed in their native countries, and some of them, especially certain species from the North-west of America, have quite outstripped, in height and girth of stem, the Larch, Scots Fir, and Norway Spruce, growing alongside and planted at the same time.

Coming to England in 1856, the “Conifer rage,” as it was popularly characterised, was then approaching its height. The Wellingtonia, the “Mammoth Tree” of California, which had been lately introduced, was being distributed over the length and breadth of the land, and connoisseurs in Conifers pointed out

with pride and pleasure to their wondering and admiring friends the sapling giant, which they considered cheap at "a crown an inch"! Residing in England for nearly a decade, and in half a dozen widely separated counties, many opportunities occurred, of which advantage was taken, for observing the habits and rate of growth of the new Conifers, and noting their merits and value under varying circumstances and different methods of treatment. Scarcely a noted collection in the country but was visited and examined with keen interest during that period, and much valuable information as to their general treatment and special requirements was gathered.

Crossing to Ireland in the latter half of 1865, the next six years were passed in that favoured country for Conifers, particularly for those of a somewhat tender nature. Residing at Powerscourt, in the County of Wicklow, and actively engaged under Viscount Powerscourt in the formation of the extensive collection of Conifers for which that beautiful estate is well known, a wide field of practical knowledge was opened up, from which much special information was acquired in regard to the cultivation, growth, and merits of all the hardy species of Conifers. Since returning to Scotland in 1871, to fill my present office at Dalkeith under the Duke of Buccleuch, scarcely an opportunity has been missed, in any part of the United Kingdom where duty called or friendship led, for increasing my knowledge of the merits and qualities, good or bad, of the various species of the Coniferæ.

Knowing well that unsupported testimony in respect to questions of this nature, however wide and long sustained the personal experience may have been, is liable to be obstinately doubted and proof called for, I have taken the precaution, through the willing aid of numerous friends, to whom I am much indebted, to provide substantial grounds of proof, which all may examine, in support of the value I may place upon any coniferous tree or shrub grown in Britain. That evidence has been gathered within the last few weeks from almost every part of the British Isles where Conifers are growing—from the southern counties of England and Ireland to the Orkney Islands, and from the eastern coasts of Great Britain to the wind-swept wilds of Connemara, where *Pinus insignis* and *Cupressus macrocarpa* luxuriate in the moist and saline-laden

breeze from off the Atlantic. The details collected from that wide area will be found in tabulated form at page 481.

In treating of such Conifers as give promise of forming useful forest trees, the timber of which may be applied to constructive purposes with fairly good results, we will take them in alphabetical order, as being the most convenient method for our purpose. The trees selected have attained to timber dimensions in some parts of the United Kingdom, and on certain soils and situations they are found to thrive well, and grow with vigour and rapidity, of which note will be made in proceeding. The girth given of the stem is always at 5 ft. from the base of the tree, unless a different height is expressly stated.

Abies Albertiana (Prince Albert's Fir)—or, as it is now called by botanists, *Tsuga Mertensiana*—is one of the finest and hardiest of Jeffrey's introductions from the North-west of America, which he sent home to the Oregon Association in 1851. It is already tolerably common in Scotland, although seldom met with except in ornamental grounds in the other divisions of the United Kingdom. It is seen thriving and growing with marked rapidity in many northern districts, as well as at rather high altitudes, wherever it has been planted with ordinary circumspection, and it is likely to prove one of the most useful, as it is one of the most graceful, of the new Conifers introduced by the Scottish Society. At Balmoral, Aberdeenshire, planted 26 years ago, it has attained a height of 35 ft., with a girth of 2 ft. 6 in., at an altitude of over 900 ft., and of the many trees growing there, all seem to be perfectly at home. At Castle Menzies, Perthshire, it is 72 ft. high and 5 ft. 9 in. in girth; at Munches, Kirkcudbrightshire, 69 ft. high and 4 ft. 3 in. in girth; at Riccarton, Midlothian, 68 ft. 6 in. high and 3 ft. 2½ in. in girth—these being noted places for fine collections of Conifers, and where this tree was planted soon after its introduction to this country, exactly 40 years ago. At The Cairnies, Perthshire, at an altitude of 630 ft., it is 63 ft. high and girths 6 ft. 9 in., the greatest girth recorded. At Dolphinton, Lanarkshire, at an altitude of 830 ft., it is 55 ft. high and 3 ft. 6 in. in girth, raised about 27 years ago from home-grown seed. In England the tallest tree recorded is at Linton Park, Kent, a well-known home for exotic Conifers,

68 ft. high and 4 ft. 3 in. in girth. In Wales it grows freely, and at Stackpole Court, Pembrokeshire, it is 56 ft. high and 6 ft. 5 in. in girth, at 35 years old; and at Golden Grove, Carmarthenshire, it is 52 ft. high and 6 ft. 5 in. in girth, at the early age of 22 years. It also seems to be quite at home in Ireland, the finest trees recorded being at Shane's Castle, Antrim, 49 ft. 6 in. high and 3 ft. 11 in. in girth, at 27 years of age; at Baron's Court, Tyrone, 48 ft. high and 3 ft. in girth, at 32 years; and 46 ft. high and 4 ft. 2 in. in girth, at 24 years of age, at Powerscourt, Wicklow. The wood is of good quality, and, so far as such a recent introduction has yet been tested, it is fairly durable, clean in the grain, and suitable for all ordinary purposes; and its bark, like that of its near relation the Hemlock Spruce (*Tsuga* [*Abies*] *canadensis*), may be found to be useful to the tanner when it can be produced in quantity at a moderate cost.

Abies cephalonica (Grecian Fir) was introduced by General C. J. Napier, from Cephalonia, in 1824, and is now generally disseminated over the country. Where it escapes injury from spring frost, to which it and several others of the Fir tribe are rather liable in a young state, it grows with freedom and forms a fine tree. The tallest recorded is at Studley Royal, Yorkshire, 75 ft. high and 8 ft. 3 in. in girth; and the tree with the greatest girth is at Boconnoc, Cornwall, which, with a height of 73 ft., has a girth of 9 ft. 6 in.; but it is nearly equalled by one at Linton Park, which is 9 ft. 4 in. in girth and 70 ft. high. The finest in Scotland in the recording tables is at Whittinghame, East Lothian, 55 ft. high and 8 ft. in girth. The best in Ireland is at Woodstock, Kilkenny, 61 ft. high and 8 ft. 6 in. in girth. It is chiefly grown for ornamental purposes, and succeeds well even in the far north of Scotland; but the figures given show that it may be planted as a forest tree, with good prospects of a profitable result, where its peculiarities are suited and Fir timber of average quality is in demand. It generally thrives best on a north aspect.

Abies concolor.—This very fine Fir was introduced from Northwest America in 1851 by both Jeffrey and Lobb. It is a variable species with several varieties, the best known being *A. lasiocarpa*, which has an upright habit of growth with a slender stem, and *A. Lowiana*,* with wider spreading branches and

* See Dr. Masters' Synopsis, p. 192.

generally a rather thick stem. Both varieties grow vigorously, and are among our hardiest Conifers when grown on well-drained land and in situations not too much affected by spring frost. The species has been freely planted, and when standing clear of other trees it forms a very handsome and well-furnished specimen. As a forest tree its clean rapid growth, and the quantity of timber it makes in a given time, render it a fit subject for a wider trial than has yet been given to it. The finest tree recorded is at Linton Park, 64 ft. high and 8 ft. 7 in. in girth. The tallest tree in Scotland is at The Cairnies, where it is grown as a forest tree, 55 ft. high and 6 ft. in girth; the tree with the greatest girth being at Brahan Castle, Ross-shire, and is the thick-stemmed variety *Lowiana*, a very fine ornamental tree, girthing 7 ft., but only 40 ft. high. In Ireland the tallest is at Coollattin, Wicklow, and is 46 ft. high and 4 ft. 3 in. in girth; but the tree recorded at Abbeyleix, Queen's County, girths 6 ft. 10 in., and is 45 feet high. These figures indicate vigorous growth and excellent wood-producing qualities in the forty years which have elapsed since the seed of this tree arrived in Britain.

Abies Douglasii (Douglas's Fir)—now known to botanists as *Pseudotsuga Douglasii*—is a grand tree in every respect, and so far has proved to be the most valuable Conifer introduced to Britain since the Larch reached our shores early in the seventeenth century. It was one of the first Conifers sent home by Douglas to the Royal Horticultural Society, in 1827, from the North-west of America, and worthily bears the name of that intrepid explorer of the primeval forests of the Far West. It has long been a favourite with the tree-planter, and under suitable conditions no tree grows more satisfactorily. Of late years it has been freely used as a plantation tree, raised chiefly from home-grown seed, which is produced in abundance. It is thus raised in large numbers at a comparatively small cost, so that it can be planted in quantity as a forest crop at about the same rate as ordinary forest Conifers, all of which it quickly leaves far behind in height and girth of stem. To see it at its best as a forest tree at the present time one has to visit some of the Perthshire estates, where for many years it has been more frequently planted than any other one of the newer Conifers. At Scone (of which David Douglas was a native), Murthly, The Cairnies, and many other places it is planted in

quantity, thriving well in the woods, under ordinary treatment, along with the common coniferous trees, and occasionally forming plantations by itself, as on the Scone estates. The tallest tree recorded is the famous Douglas Fir at Dropmore, Buckinghamshire, which is 120 ft. high and 11 ft. in girth. The equally famous trees—there are two of them—at Lynedoch, Perthshire, are respectively 91 ft. 9 in. high and 12 ft. in girth, and 72 ft. 2 in. high and 11 ft. 2 in. in girth. These fine trees grow in a free loamy soil, at an altitude of 340 feet, in a tolerably well-sheltered spot, near the small river Almond. They are the oldest trees of the Douglas Fir in the district, and were planted in the year 1834. The smaller tree is the prolific seed-parent of the many thousands of the Douglas Fir now growing on the Scone estates. Two plantations of pure Douglas Fir have been formed on the estates, of trees the progeny of the seed-bearing one at Lynedoch. The one at Scone was planted in 1857, and the other at Taymount, a few miles distant, in 1860. They both stand at about the same altitude, 250 to 300 feet, on a moorish soil with a tilly subsoil; and the dimensions of some of the trees at the present time, given in the table furnished by Mr. Bayne, forester to the Earl of Mansfield, for this Conference, tells a very satisfactory tale.

Other trees of the Douglas Fir recorded in the tables that are over 90 ft. high in Scotland, are at Dunkeld, 94 ft. high and 12 ft. in girth; at Castle Menzies, 92 ft. high and 7 ft. 1 in. in girth; and at Durris, Kincardineshire, 90 ft. high and 10 ft. 3 in. in girth. Nine more trees are recorded from 80 to 90 ft. in height and from 6 to 12 ft. in girth. It is notable that three trees (at Lynedoch and Dunkeld, Perthshire, and at Buchanan, Stirlingshire) are all recorded of the greatest girth—12 ft.; and that eight others in Scotland girth over 10 ft., one of these growing as far north as Dunrobin, Sutherlandshire, and girthing 10 ft. 10 in. To return to England for a moment, where the splendid tree at Dropmore bids fair to rival at no distant time its stately progenitors in British Columbia, we find the Douglas Fir thriving well in every part, except in the chalk districts and on strongly calcareous soils, for which it is not adapted, and should not be planted thereon if profitable trees are desired. In the cooler soils in the north and west of England it thrives admirably; at Hewell, Worcestershire, it is 75 ft. high and 6 ft. 6 in. in girth, growing on "the highest tableland in England;" at

Mulgrave Castle, Yorkshire, 66 ft. high and 7 ft. 10 in. in girth; at Orton Longueville, Huntingdonshire, 65 ft. high; at Revesby, Lincolnshire, 62 ft. high and 7 ft. 1 in. in girth; at Golden Grove, Carmarthenshire, 62 ft. high and 7 ft. in girth; and at Howick, Northumberland, 60 ft. high and 7 ft. 4 in. in girth, and all generally described as being healthy and vigorous. The tallest tree recorded in Ireland is at Castlewellan, Down, which is 100 ft. in height, but no girth is given. The tree with the greatest girth grows at Coollattin, and girths 10 ft. with a height of 74 feet. At Markree, Sligo, a tree is recorded 80 ft. high and 5 ft. 2 in. in girth; on Fota Island, Cork, 80 ft. high and 6 ft. 3 in. in girth; and at Powerscourt, 75 ft. high and 7 ft. in girth. Great numbers of the Douglas Fir have been planted all over Ireland, where it promises to prove, in suitable soils and situations, one of the best and most thrifty of forest trees. At Powerscourt, in Wicklow, where almost every exotic Conifer that will live in the open air has been planted, and where many of them are thriving remarkably well, Lord Powerscourt thus expresses his opinion of the Douglas Fir in a letter to the Secretary in reference to this Conference: "Of all the trees I have planted here—and I have planted many thousands of the rare Conifers—*Abies Douglasii* is the best and finest of them all;" very high praise indeed, coming from such an experienced and impartial authority. The timber so quickly produced in Britain by the Douglas Fir has been submitted to many severe tests, and has come through them all with marked success, proving it to be, even at the early age at which it has been used, one of the very best of the coniferous woods grown in this country.

Abies grandis is another of the giants introduced by Douglas in 1831 from North-west America, which grows with great vigour in the British Isles under much the same conditions as the Douglas Fir, and, not being at all fastidious as to soil, it is sometimes seen outstripping that rapid grower on poor and cool ground. It was not, however, till the days of Jeffrey and Lobb that fertile seed of this valuable Conifer arrived in Britain in any quantity, and the finest trees of it in Scotland are the produce of the importations made by the Oregon Association. The tallest tree recorded grows at Riccarton, Midlothian, 83 ft. 3 in. high and 3 ft. 8½ in. girth; this particular tree having been carefully

measured by the owner, Sir James H. Gibson Craig, Bart., and found to have grown 53 ft. in height in the last twelve years, or an average of 4 ft. 5 in. annually—a most remarkable growth, and showing what the tree can do in fair soil under good treatment. The late Baronet of Riccarton, Sir James's father, was a leading member of the Oregon Association, and the collection at Riccarton, which has always been tended with the greatest care, is at present the finest in the county, and contains many beautiful specimens of new and rare Conifers. The next tallest tree is at Dolphinton, a high-lying estate at the south end of the Pentland hills, where the owner, John Ord Mackenzie, Esq., an enthusiastic admirer of Conifers, has grown them with great success for many years, and his *Abies grandis* is 68 ft. high and 5 ft. 5 in. in girth. The tree with the thickest stem in Scotland grows at Poltalloch, Argyllshire, and girths 7 ft. 9 in., with a height of 64 ft. The tallest tree in the English record is at Revesby, 70 ft. high and 6 ft. 6 in. in girth; and the one with the thickest stem is at Golden Grove, which girths 7 ft. 8 in. and is 60 ft. high. This tree seems specially well suited for Ireland, where it grows with great vigour and makes a fine clean straight stem. The tallest recorded is at Carton, Kildare, 80 ft. high and 6 ft. in girth; and the thickest stem is at Curraghmore, Waterford, 8 ft. in girth and 68 ft. high. Planted side by side with the Douglas Fir at The Cairnies, on a poor moorish soil and tilly subsoil, it is now, at thirty years of age, slightly the superior both in height and girth. As a timber tree it will undoubtedly take a front place among the Firs.

Abies magnifica is in truth a stately tree, and one of the handsomest of all the taller-growing Conifers for ornamental purposes. We are indebted to Jeffrey for its introduction in 1851, through the Oregon Association, from that fertile region of majestic Conifers—North-west America. No doubt, owing to the source through which it first arrived in Britain, it is much more common in Scotland than in England or Ireland, but its desirable qualities as a decorative tree are appreciated by all who have seen the many fine specimens scattered over the North, and it will yet become a popular tree all over the country. Like several of the beautiful Firs, the native habitat of which extends over several degrees of latitude in North America, this species exhibits considerable variety in habit, according to the locality

in which it grows in a state of nature. To this characteristic, probably, may be ascribed much of the vexatious confusion which has arisen in regard to the identity of this and several other perfectly distinct Conifers. This species was introduced from its southern habitat, and widely distributed in Britain in the "fifties," and onwards, as the "*Abies amabilis* of Douglas," and to this day it is known in many places only by that erroneous appellation. It is well known that trees over 10 ft. high of Douglas's *Abies amabilis* (Lindley) are extremely rare in Britain. In collecting my statistics, however, I have had a large number of specimens of "*Abies amabilis*" returned between 30 and 70 ft. in height, most of which I have found, on examining samples of them, to be *A. magnifica*; the remainder including such diverse species as *A. Albertiana*, *A. concolor*, *A. grandis*, *A. nobilis*, *A. Nordmanniana*, *A. pectinata*, and *A. Webbiana*, but not a single specimen of the true *A. amabilis* among them all. In Scotland, *Abies magnifica* thrives well at The Cairnies—the finest tree there, and the finest recorded, being 50 ft. high with a girth of 3 ft. 6 in.; and at Durris it is 45 ft. high and 4 ft. 2 in. in girth. In England the best tree recorded is at Revesby, 40 ft. high and 5 ft. in girth. It does well in Ireland, and specimens are growing at Abbeyleix 40 ft. high and 4 ft. 4 in. in girth; at Shane's Castle, 35 ft. 10 in. high and 3 ft. 2 in. in girth; and at Powerscourt, 35 ft. high and 4 ft. in girth. It is one of the very hardiest of the Firs, and is seldom affected by spring frost; and the timber being straight, clean-grained, and of good quality, it will no doubt be a useful forest tree.

Abies Menziesii (Menzies' Spruce)—or, as it is now called by botanists, *Picea sitchensis*—is still another of the giants of the forests of North-west America, which in suitable soils of a moist, cool nature has made remarkable progress in Britain, particularly in Scotland, and in some parts of Ireland, for which its seems specially well adapted. It was introduced by Douglas in 1831, and found its way over the country along with the Douglas Fir, but it has never become so popular as that species, although it will grow and thrive well in soils and situations where the Douglas Fir grows with much less vigour, if it thrives at all. The finest tree recorded in Scotland grows at Castle Menzies, and is 46 years old; 96 ft. 6 in. high and 11 ft. in girth, as accurately measured a few days ago for this Con-

ference. Near Castle Menzies, in the Perthshire highlands, Archibald Menzies was born in 1754, after whom Douglas named this fine Conifer, which was first discovered by Menzies about 100 years ago, when accompanying Vancouver, as naturalist, in his celebrated voyage of discovery round the world. Many other fine trees of Menzies' Spruce grow in Perthshire, and one at least, which was measured in Keillour pinetum this autumn, but of which the exact height was not obtained (approximately guessed at over 95 ft.), was found to be of the great girth of 13 ft. 9 in. at five feet up, and carried its straight massive bole high up the tree with comparatively little taper. This tree is known to have been planted in 1834, or fifty-seven years ago, and this great girth shows an average annual increase of about 3 in. throughout that long period. The tree when planted was a small one, like all the others employed in forming the pinetum at that date, and had probably not reached 5 ft. in height two years afterwards, which would give exactly 3 in. annual increase of girth in fifty-five years. The tallest tree recorded in England is at Howick, Northumberland, 90 ft. high and 9 ft. in girth; and the one with the thickest stem is at Boconnoc, Cornwall, 12 feet in girth and 85 ft. high. The finest tree in Ireland, and the tallest recorded in the United Kingdom, is at Curraghmore, 110 ft. high and 10 ft. in girth. Another tree, at Coollattin, is 80 ft. high and 9 ft. in girth; while at Markree there is one 75 ft. high and 4 ft. 10 in. girth; and at Shane's Castle 71 ft. high and 9 ft. in girth. All these dimensions show a great production of timber in the period, and the excellent quality of the wood places this tree at the head of the Spruces, and the most valuable of that tribe as a forest tree in soils and situations where it thrives. It is well known to be quite unsuitable for dry and hot soils, and should not be planted on them as a timber tree.

Picea (Abies) Morinda (Indian Spruce), also known as *Abies Smithiana*, is the only Spruce from the North of India which is of any value as a forest tree. Although it is tolerably hardy, and thrives well in favourable situations as far north as the Moray Firth, its rather slow progress is against its general use for a timber tree; but for ornamental purposes, in suitable soils and proper sites, it is of great value, and forms a very effective and picturesque tree. It was introduced from India to Scotland by Dr.

Govan, of Cupar, Fife, in 1818, who gave the seed of it to the Earl of Hopetoun, and his gardener, Mr. James Smith—after whom the tree was named *A. Smithiana*—raised the first plants of it in Britain, one of which is still growing and thriving well at Hopetoun, in West Lothian. It is the finest tree recorded, being now 76 ft. high and 8 ft. in girth. The next is in England, at Linton Park, 71 ft. high and 8 ft. in girth; and the third in Ireland, on Fota Island, 62 ft. high, but only 4 ft. 3 in. in girth. Many fine specimens growing in various parts of the country exceed 6 ft. in girth and are about 60 ft. high. It is, like all the Spruces, not well suited for growing on dry, parched soils, but thrives with much vigour and freshness on those of a cool, moist nature, which are not sour from stagnant moisture.

Abies nobilis is still another of the valuable Conifers sent from North-west America by the indefatigable Douglas to the Royal Horticultural Society in 1831, and which has thriven remarkably well, in places that suit it, throughout the length and breadth of the United Kingdom. The strong, gross, brittle leader which it sends up when growing in good soil is apt to get broken by the wind in exposed places, and in damp or low-lying spots it occasionally suffers from frost-bite in spring, but on well-chosen ground and moderately sheltered sites it grows rapidly and forms timber quickly, which is straight, but rather coarse and soft even for a Fir. The tallest tree recorded grows at Birr, King's County, Ireland, which is 83 ft. high and 6 ft. in girth. The next is in Scotland, at Keir, Perthshire, 82 ft. high and 5 ft. 8 in. in girth; but the finest tree of it in Scotland is probably the splendid specimen at Coul, Ross-shire, which is 77 ft. 6 in. high, 7 ft. 10 in. in girth, and beautifully furnished from base to apex with branches clothed with the rich silvery foliage which renders the glaucous variety of *A. nobilis* one of the best of ornamental coniferous trees. The best recorded in England is at Linton Park, and is 72 ft. high and 6 ft. 4 in. in girth. Taking it all round, it is likely to prove only a second-rate forest tree, but quite first-rate as a decorative Conifer.

Abies Nordmanniana (Nordmann's Fir) is said to have been introduced into Britain from Eastern Europe so recently as 1848, and until the past few years it was popular with planters, but its apparent liability to insect attack has caused it to be looked upon

with suspicion in many places where it formerly thrived well. Nevertheless, where it is free from insects, it is a fine handsome Conifer, and grows moderately fast as a timber tree. The wood is a good quality of Fir, and where the tree thrives it is not to be despised in a forest. The finest tree recorded is at Potalloch, Argyll, 70 ft. high and 6 ft. in girth; the next in Wales, at Penrhyn, 70 ft. high. The tallest in Ireland is at Markree, 60 ft. high and 2 ft. 10 in. in girth; and the thickest stem at Killarney, 10 ft. 6 in. in girth and 50 ft. high.

Araucaria imbricata (Chilian Pine) is the most distinct, and probably the most effective in contrast with other trees, of all the Conifers that have been introduced into Britain. Although brought home from Chili by Archibald Menzies, naturalist to Vancouver's expedition, as far back as 1796, very few specimens in this country are over fifty years old. Since then, however, it has been a favourite with the ornamental planter, and in suitable places it thoroughly deserves the prominence that has been given it as a landscape tree. It is one of the hardiest, as it is the sturdiest, of all Conifers in withstanding the force of the wind. It thrives well, and grows with a straight upright stem, in exposed places where few other trees can struggle upwards with stems lying at any angle above the horizontal. It thrives with remarkable vigour in the moist climate of our western coasts, where on open free soil through which water freely percolates it keeps pace in height with common forest trees. In the western islands of Scotland it grows and thrives remarkably well; and even in the Island of Shapinshay, one of the Orkneys, it is among the tallest of the Conifers which can be grown in that stormy latitude and maritime climate. Its usual growth in the drier parts of the British Isles seldom exceeds a foot in height annually, often much less; but in the moisture-laden air of our western shores it makes a growth of 18 in. in many localities, and in those parts may yet form a valuable timber tree, as the stem is always perfectly straight and the wood of excellent quality. The grand specimen at Dropmore, of which all Conifer lovers have heard, if they have not seen it, is 68 ft. 6 in. high and 8 ft. in girth, the finest tree probably in the northern hemisphere of the *Araucaria imbricata*. It is sixty-one years old, in vigorous health, and growing freely. The next tallest recorded, and a very fine tree too, is in Scotland, at

Poltalloch, and is 55 ft. high and 6 ft. in girth. The third is in Ireland, at Woodstock, 54 ft. high and 8 ft. 4 in. in girth; and a fourth at Dupplin, Perthshire, is 54 ft. high and 5 ft. 6 in. in girth. Many others are recorded from 40 to 50 ft. in height and from 4 to 6 ft. in girth, and most, if not all, of these are under forty-five years of age.

Cedrus atlantica is a comparatively fast-growing tree in many localities, and as a rule forms a cleaner stem than either the Cedar of Lebanon or the Deodar. It was introduced to Britain in 1841, exactly fifty years ago, and has been much planted as an ornamental tree, but is not often seen except in pleasure-grounds or as a park tree. The tallest recorded is at Mulgrave Castle, Yorkshire, 66 ft. high and 5 ft. 10 in. in girth; and another at Orton Longueville is 60 ft. high. In Scotland, at Hopetoun, it is 59 ft. high and 6 ft. 8 in. in girth; at Whittinghame, 59 ft. high and 6 ft. 6 in. in girth; and at Cultoquhey, Perthshire, 59 ft. high and 6 ft. in girth. The finest in Ireland is at Carton, Kildare, 56 ft. high and 8 ft. in girth.

Cedrus Deodara (Deodar or Indian Cedar) is the most graceful of the family, or rather species, as it is generally agreed that the three well-known types—Lebanon, Indian, and Atlantic—are only distinct varieties of the same species, and has been much more freely planted as an ornamental tree than either of the other two within the past half-century. It was introduced to Britain from India in 1831, exactly sixty years ago. As a decorative tree it has few rivals among Conifers when growing in a suitable soil under favourable conditions. As forest trees the Cedars are not likely to occupy more than second rank in this country; still, in favoured spots and under special conditions, they may be found to be worth their room as timber trees. The finest Deodar recorded in Britain is at Studley Royal, 70 ft. high and 7 ft. 6 in. in girth; the next, at Rossie Priory, Perthshire, 70 ft. high and 5 ft. 9 in. in girth; and the third, on Fota Island, 65 ft. high and 6 ft. in girth. The tree with the greatest girth of stem is at Coollattin, which girths 10 ft. 6 in., and is 46 ft. high. There is another at Linton Park, 9 ft. 6 in. in girth and 60 ft. high.

Cryptomeria japonica (Japan Cedar) is another of the Conifers introduced to Britain by the Royal Horticultural Society—Robert Fortune having sent seed of it to the Society from China in 1844,

It thrives fairly well in many parts of the country, especially in Ireland and in sheltered places along the western shores of Great Britain, preferring a moist climate and a well-drained soil. It is a useful and very effective ornamental tree, but its progress so far in this country does not give evidence that it will ever attain with us the important position it occupies among timber trees in China and Japan. The tallest tree recorded in the United Kingdom grows at Coollattin, and is 67 ft. high and 5 ft. in girth; another, on Fota Island, is 56 ft. high and 3 ft. 6 in. in girth; while the third, in Ireland, is at Powerscourt, 48 ft. high and 7 ft. 6 in. in girth. The finest in England is at Boconnoc, 64 ft. high and 7 ft. in girth; and the tallest in Scotland grows at Riccarton, and is 43 ft. high and 2 ft. 8 in. in girth; another, at Keir, Perthshire, being only 6 inches less in height, with a girth of 9 ft. 8 in., the greatest girth recorded.

Cupressus Lawsoniana is among the most recent and valuable of all the coniferous trees which have been introduced to Britain from the North-west of America. It was sent home to Messrs. Lawson & Son, Edinburgh, by William Murray in 1854, and as it has proved one of the hardiest, and seeds abundantly, it is now one of the commonest of the newer Conifers, and grows freely in all parts of the country. Having spread from Edinburgh, it naturally found its way over Scotland faster than in the other divisions of the United Kingdom, and we therefore find most of the large and vigorous trees in the North. At Dupplin it is 55 ft. high and 4 ft. 3 in. in girth; Rossie Priory, 55 ft. high and 4 ft. in girth; and Murthly, 50 ft. high and 3 ft. 8 in. in girth. All these are in Perthshire, but numerous trees of 40 to 50 ft. in height, and even greater girth than any of the foregoing, are recorded in most parts of Scotland. The tree with the thickest stem grows at Torloisk, in the Isle of Mull, and girths 8 ft. 6 in., with a height of 34 ft. 6 in. The finest tree in England is at Linton Park, 47 ft. 6 in. high and 4 ft. 5 in. in girth. The finest in Ireland grows at Killarney, and is 46 ft. high and 6 ft. 2 in. in girth. Seeing that the tree has been only thirty-seven years in this country, these figures show a free growth of wood, and the quality of the timber, so far as it has been yet available and tested in Britain, indicates a useful forest tree; and the ornamental qualities of its best varieties give it a high value as a decorative Conifer.

Cupressus macrocarpa is one of the fastest-growing and most beautiful of the trees of California which have proved fairly hardy in Britain. The variety with a spreading habit, introduced in 1838 under the name of *C. Lambertiana*, is perhaps the most ornamental; but the typical variety—introduced by Hartweg from California, through the Royal Horticultural Society, in 1846—with an upright habit and straight stem, is much the best forest tree. It grows very freely, and is tolerably hardy on light warm soils in many parts of the country, but it thrives best and is a most useful tree in the moist climate of our western coasts, where numerous fine specimens are growing with the greatest vigour and forming splendid trees. In its native habitat, in Monterey County, California, it grows along the coast of the Monterey peninsula in the full sweep of the wind from the Pacific Ocean, as graphically described in a letter I lately received from Mr. Thomas Lee, a gardener who lives in Monterey, and knows the district and trees thoroughly well. He says: "*Cupressus macrocarpa* is found growing in natural forests a few miles to the south of the City of Monterey, and at Cypress Point they grow with great vigour and tenacity right over the sea-bluffs in the full force of the gales from the Pacific, clinging with a firm grasp of their strong roots to the face and crown of the bluffs, and defying the strongest storms to uproot them. On the crest of the bluffs the trees are much bent over, with the boughs gnarled and distorted by the force of the fierce blast, but a short distance inland they rear their heads straight into the air and form splendid trunks, five of which, taken at random, I measured for you and found them to be in girth as follows: 10 ft. 4 in., 11 ft., 12 ft. 8 in., 13 ft. 6 in., and 15 ft., all taken at 5 ft. from the ground. The average height of the trees at this spot would be about 80 ft., but they reach a much greater height further inland. When the noted Hotel del Monte (Hotel of the Woods) was built, about a dozen years ago, the land between it and the Bay of Monterey, about 1,000 yards wide, was principally sandhills or dunes, which were continually shifting with the action of the wind. The gardener at that time, a Mr. Ulrich, conceived the idea of planting the sands with Cypress and Pines (*Pinus insignis* and *P. muricata*) almost to high-water mark, as a shelter and wind-break to the hotel and grounds. Hundreds of loads of soil were carted to plant the trees

in, the Pines being dug up in the woods and the Cypress raised from seed. The trees nearest the bay were planted several times before success was attained, but with the low shelter of a bush-fence, made of the branches of Lupines—*Lupinus arboreus* and *L. littoralis*, both admirably suited for the purpose—the trees ultimately got a start, and the whole dunes are now covered with a forest of healthy trees, which have proved an effectual wind-break. At ten years old from the seed, the average height of the Cypress is about 10 feet.” The excellent qualities of the Monterey Cypress as a maritime tree have already been proved in Britain. In the storm-swept district of Connemara, in the west of Ireland, it is reported by Mr. Farmer, Kylemore, Galway, as follows: “By far the best of all the species of Conifers growing here for withstanding the salt breeze (from the Atlantic) are *Pinus insignis* and *Cupressus macrocarpa*, which seem to grow with increased vigour under its influence, and have far outstripped all other Conifers in their growth.” From the Island of Mull and from the Orkneys come the same report as to its high merits as a seaside tree, and where it is found to thrive so vigorously under such conditions it will prove a valuable Conifer to plant. The tallest tree recorded in Britain is on Fota Island, and is 76 ft. high. At Castlewellan it is 70 ft. high; at Coollattin, 64 ft. high and 9 ft. 3 in. in girth; and at Powerscourt, 63 ft. high and 7 ft. 6 in. in girth, all showing its adaptability for the soil and climate of many parts of Ireland. The tallest tree recorded in England is at Linton Park, 61 ft. high and 8 ft. in girth; and in Scotland, on the Island of Bute, 57 ft. high and 5 ft. 8½ in. in girth.

Cupressus nootkatensis, or, as it is perhaps still better known, *Thuyopsis borealis*, is one of the very hardiest and most beautiful of all the Cypress tribe, and appears to thrive everywhere in the British Isles. It was discovered by Menzies at Nootka Sound, Vancouver’s Island, in 1794, but did not reach this country till about forty years ago. Since then, however, it has made rapid progress in popular favour as a handsome ornamental tree which will thrive in almost any place and soil not too hot and dry. As a timber tree its branchy habit is somewhat against it, but when care is taken to plant the trees close, and to see that a leader gets a start, it, like most other Conifers of the same habit, quickly forms a clean straight stem, of which the timber is of

excellent quality and very useful. The tallest tree recorded in Britain is at Murthly, 50 ft. high and 1 ft. 9 in. in girth; a second in Ireland, at Woodstock, 50 ft. high; the next at Brahan, Ross-shire, 45 ft. high and 2 ft. 8 in. in circumference; and the fourth at Powerscourt, 40 ft. high and 4 ft. in girth. The tallest in England are at Revesby, 40 ft. high and 2 ft. 6 in. in girth; Orton Longueville, 40 ft. high; and at Cheswardine, Shropshire, 40 ft. high.

Pinus.—Many species of the Pine tribe have been introduced to Britain; but, on the whole, they have not proved so valuable with us, either as ornamental or timber trees, as those of the Fir, Spruce, and Cypress tribes, although a few are notable exceptions to the general rule, and are found to be most useful trees for certain situations, soils, and purposes. We may, therefore, deal with them shortly, noticing only the most useful.

*Pinus austriaca** is a capital wind-break, but a coarse timber tree of indifferent quality, and too sombre to be a favourite ornamental tree where better kinds will grow. The finest tree recorded in the tables is at Linton Park, 74 ft. high and 8 ft. in girth. The tallest in Scotland, at Whittinghame, 51 ft. 6 in. and 6 ft. 9 in. in girth; and in Ireland, 55 ft. high and 11 ft. 9 in. in girth, at Shane's Castle.

Pinus Cembra is one of the most distinct species of Pine, and from its compact columnar habit it is a very useful ornamental tree. It is too slow-growing in this country to make a useful forest tree. The finest tree recorded of this species is also at Linton Park, 68 ft. 6 in. high, with a girth of 5 ft. In Scotland, it is 55 ft. high and 7 ft. in girth at Abercairney, Perthshire; and at Balmoral, at an altitude of over 900 ft., it has attained a height of 42 ft., with a girth of 4 ft. 1 in., growing with vigour and forming a distinct and pleasing feature in the Royal pleasure-grounds. The finest in Ireland is at Garbally, Galway, 50 ft. high and 6 ft. 8 in. in girth.

Pinus excelsa, from the North of India, thrives fairly well in favoured sites, and is then a very ornamental tree; but in exposed places it soon becomes ragged and unsightly. It grows and forms wood moderately fast, but it is of little value in this country as a timber tree. The tallest recorded is at Studley

* Now botanically known as *P. Laricio nigricans*. Vide p. 232.

Royal, 70 ft. high and 6 ft. in girth ; the next at Orton Longueville, 69 ft. high ; and at Linton Park, 60 ft. high and 3 ft. 8 in. in girth. In Scotland, at Munches, it is 60 ft. high and 6 ft. 1 in. in girth. At Coollattin, in Ireland, it is 16 ft. in girth and 44 ft. high.

Pinus insignis is the fastest growing of all the Californian Pines introduced to this country, and in a suitable soil and climate it soon forms a large and well-furnished tree. It is a native of the Pacific coast in California, and was introduced to Britain by Douglas in 1833. It is not sufficiently hardy to form a useful forest tree in most parts of England and Scotland, but notable exceptions to the general rule are seen near the coasts in both countries, and also far inland, as, for instance, the splendid trees of it growing at Dropmore. It is in Ireland, however, where the tree is seen growing most frequently with the greatest vigour, and for many parts of that country it is one of the most useful of forest trees. As mentioned when speaking of the Monterey Cypress, *Cupressus macrocarpa*, this is also a first-rate tree for withstanding the saline breeze in maritime districts ; and I may again quote a few lines from Mr. Lee's letter, bearing directly on *Pinis insignis* in its native habitat : "The *Pinus insignis* grows wild on the high ground and mountain-sides around Monterey, and away round Point Pinos and to the southward along the coast for many miles, in full exposure to the heavy gales from the Pacific Ocean, and flourishes there much better than in the drier parts of the County of Monterey lying beyond the mountains and sheltered from the ocean breeze. It reproduces itself freely from seed, and frequently in the forest a few square feet of ground will furnish a hundred or more of nice seedlings, which we lift and transplant with perfect success. The tree grows rapidly, and for a number of years it is well clothed with its grass-green leaves, and is very handsome ; but when it attains a good age and full height, the lower branches gradually disappear and the tree becomes flat-headed. The wood is not considered of much value here, where we have abundance of fine timber from other trees ; but it is largely used for common purposes, and furnishes the principal fuel of the district, its heating powers being among the best of our native trees. I have before me the dimensions of the fine *Pinus insignis* at Linton Park, Kent,

England, when measured in 1877, namely, 68 ft. high, with a girth of 9 ft. at 3 ft. up, and a spread of branches 52 ft. in diameter. Of course it will be much larger now, if still alive, but it was then the best I had seen. I have just measured a few natural trees here for comparison, and find their girths are as follows: 10 ft. 2 in., 9 ft. 3 in., 9 ft. 2 in., 10 ft. 5 in., 10 ft. 8½ in., 9 ft. 10 in., and 11 ft. 4 in., all taken at 5 ft. from the ground. They will average about 100 ft. in height, and are a fair sample of the Pine growing in the natural forest around here." These remarks by Mr. Lee coincide with the character of the tree where it grows freely in Britain, and indicate the localities where it may be planted with the best results. The tallest recorded in Britain is the fine tree at Dropmore, 90 ft. high and 11 ft. in girth, about equal to the trees at Monterey. A second tree at Dropmore is 12 ft. in girth and 79 ft. high; and one at Boconnoc is 13 ft. in girth and 68 ft. high. The tallest in Scotland is 57 ft. 6 in. high and 4 ft. 11 in. in girth, in the Isle of Bute; and the next 55 ft. high and 6 ft. in girth, in the Isle of Mull, showing the merits of the tree for insular localities. The tallest in Ireland is at Powerscourt, 82 ft. high and 10 ft. in girth; the next at Woodstock, 78 ft. high and 10 ft. 9 in. in girth; Clonbrock, Galway, 73 ft. 9 in. high and 10 ft. 8 in. in girth; Adare Manor, Limerick, 72 ft. high and 7 ft. 6 in. in girth, and so on, the big trees of *Pinus insignis* in Ireland being as thick as blackberries, particularly in the south and west.

Pinus Jeffreyi was introduced by John Jeffrey, whose name it bears, in 1852, through the Oregon Association, and, like some others of his introductions, it is more frequently seen in Scotland than in England or Ireland. It is one of the Red Pines of Northern California, and as a rule grows slower than the typical species, *Pinus ponderosa*, with which it is closely allied, and is probably only a variety which owes its characteristics to the locality it came from. The tallest tree is at Fordell, Fife, 50 ft. high and 3 ft. 6 in. in girth; in England, at Revesby, 48 ft. high and 6 ft. 8 in. in girth; in Ireland, at Powerscourt, 40 ft. high and 2 ft. 3 in. in girth.

Pinus Lambertiana is another of the giant Pines of California and northwards, introduced by Douglas in 1827, and tolerably hardy in this country, forming in isolated cases a very handsome tree, but generally speaking it does not give much promise

of ever attaining half the size it grows to on its native mountains in Northern California. So far, the timber grown in Britain does not indicate a high quality. Its extraordinary length of cone is an interesting feature, when they are produced, which has not been frequently in Britain, but it may occur oftener as the trees attain age. The tallest noted are at Revesby, 50 ft. high and 6 ft. 8 in. in girth; and at Woodstock, in Ireland, 50 ft. high and 4 ft. in girth. At Keir it is 46 ft. high and 6 ft. in girth, and at Poltalloch 45 ft. high and 9 ft. in girth.

Pinus Laricio was introduced from Southern Europe in 1759, beyond the limit assigned to the newer Conifers, but it is often classed among them, although nearly a century and a half in this country. It is a robust-growing, vigorous Pine, and on a suitable soil and situation is a good forest tree. Many full-grown trees of it are growing in various parts of the country, so that its merits as a timber tree are well known. The tallest is at Boconnoc, 79 ft. high and 5 ft. in girth. At Hopetoun it is 71 ft. high and 7 ft. 3 in. in girth; at Fota 70 ft. high.

Pinus macrocarpa, otherwise more correctly known as *P. Coulterii*, is another robust-looking Pine from California. It was introduced by Douglas in 1832, and planted to a considerable extent in Pineta and ornamental grounds in Britain, but has not proved a success either as an ornamental or a timber tree. Its enormous and strongly hooked cones are the only notable feature about it, and if they were produced freely in this country it would merit a place among interesting trees. Of the specimens recorded, the best is at Linton Park, 44 ft. high and 4 ft. 6 in. in girth.

Pinus monticola is probably the best of all the White Pines of North-west America which grow freely in this country. It was introduced by Douglas in 1831, but for twenty years afterwards few of it were planted, until Jeffrey sent home seed in quantity in 1852, the produce of which has been prettily freely planted in Scotland, and generally with very satisfactory results. It is perfectly hardy, and grows with a straight clean stem to a great height, and promises to become a useful forest tree with wood of excellent quality. The finest tree recorded grows at Scone, 71 ft. 6 in. high and 5 ft. 11 in. in girth. At The Cairnies it is 70 ft. 6 in. high and 5 ft. 3 in. in girth; at Murthly

67 ft. high and 5 ft. 6 in. girth; and at Altyre, Morayshire, 60 ft. high and 3 ft. 10 in. in girth. In England, at Orton Longueville it is 58 ft. high. In Ireland, at Woodstock, 45 ft. high and 4 ft. 8 in. in girth.

Pinus Pinaster, introduced to Britain from the shores of the Mediterranean by the Earl of Aberdeen in 1825, has been chiefly planted along our sea-coasts as a wind-break, or where no more useful tree would thrive, its well-known merits as a maritime Pine making it valuable for seaside planting, where the soil and climate suit its nature. As a timber tree it is of small value in this country, and the other products, for which the tree is highly valued in Gascony, France, and other parts where it flourishes, are not utilised in Britain. The best tree recorded is in Scotland, at Haddo, the Earl of Aberdeen's seat in Aberdeenshire, 43 ft. high and 6 ft. in girth. In England, at Hewell, it is 68 ft. high and 10 ft. in girth; and at Woodstock, in Ireland, it is 60 ft. high and 7 ft. 9 in. in girth.

Pinus ponderosa is the typical Red Pine of North-west America, and on the whole is the most satisfactory of that section which grows in Britain. Introduced by Douglas in 1827, it was nearly a quarter of a century later before it was planted freely in pleasure-grounds and Pineta throughout the country; it eventually found its way into plantations, and it is now amongst the commonest of the long-leaved Pines met with in Great Britain. It is a very sturdy and moderately fast grower in a soil and climate that suit it, and in course of time it may prove worthy of a place among timber trees, as the wood is of excellent quality when fully matured, which none of it is yet in Britain. The finest trees recorded are in England, at Linton Park, 63 ft. high and 9 ft. 2 in. in girth; and at Orton Longueville, 63 ft. high. In Scotland it is 50 ft. high and 4 ft. 6 in. in girth at Whittinghame; and in Ireland 36 ft. high and 2 ft. in girth at Powerscourt.

Pinus pyrenaica, a native of the Pyrenees as its name implies, has been grown in Britain since 1834, and thrives tolerably well in sheltered places, where as a young tree it has an attractive appearance. As a timber tree it does not yet rank high, and its chief use in this country is as an ornamental tree. At Keir it is 35 ft. high and 5 ft. 4 in. in girth; and at Glamis, Forfarshire, 32 ft. high and 3 ft. in girth.

Pinus Strobus, the Weymouth Pine, is an early introduction, having come to Britain from the eastern parts of North America in 1705, and at one time it was a popular tree with the planter, owing to the high reputation it bears as a timber tree in its native country. It has, however, failed to prove a success as a forest tree in any part of Britain, although we occasionally come across a well-grown specimen of it. Its chief use is as an ornamental Conifer, and when young and growing fast it forms a pleasing object among other trees. At Logie Almond, on the Scone estates, Perthshire, it is 90 ft. high and 7 ft. 6 in. in girth, and at Murthly 50 ft. high and 7 ft. 8 in. in girth; at Revesby it is 50 ft. high and 5 ft. in girth, and at Hewell 35 ft. high and 5 ft. 6 in. in girth.

Sequoia sempervirens is another of the gigantic trees of California for the introduction of which to Britain we are indebted to the Royal Horticultural Society, fertile seed of it having been sent home by the Society's collector, Hartweg, in 1846, from which the first plants were raised in this country. Since that period it has been freely planted throughout Britain; and although in cold, bleak situations it suffers from exposure, and is rather liable to frost-bite in spring, still in many places favourable to its growth it has attained splendid dimensions. It makes a very large bulk of timber in a given time, and it may yet prove to be a profitable timber-tree in the mild and moist climate of our western coasts, where it generally thrives well within the influence of the sea-breeze. In England, at Bocomnoc, it is 75 ft. high and 13 ft. in girth; in Ireland, at Fota, it is 75 ft. high and 7 ft. 6 in. in girth; and in Scotland, at Castle Menzies, 74 ft. high and 4 ft. 6 in. in girth.

Thuja gigantea is a rapid-growing tree of a very distinct type, which has proved itself in the highest degree a success in Britain since its introduction from North-west America by both Jeffrey and Lobb in the same year (1853). Being easily increased by cuttings, or raised from seed, which it produces freely, it soon found its way into all parts of the country, first as an ornamental tree, but for a good many years now it has been freely used in plantations, where, in suitable soil, it grows rapidly, and forms a straight, slender stem of excellent wood, which promises to rival the Larch for telegraph-poles and such-

like purposes, where straight, clean timber of equal thickness and good durability is required. As an ornamental Conifer it occupies a high place, being one of the very best of the feathery habited, erect-growing trees, which are of the greatest service to the landscape gardener, and always produce an interesting and pleasing effect. The finest tree recorded in England is at Linton Park, 65 ft. high and 6 ft. in girth; in Scotland, at Poltalloch, 65 ft. high and 5 ft. in girth; and in Ireland, at Shane's Castle, 62 ft. high and 5 ft. 2 in. in girth.

Wellingtonia, or rather *Sequoia gigantea*, the King of the Giant Trees of California, was introduced by Messrs. Veitch through their collector, William Lobb, in 1853, and about three years afterwards distributed by them—the anxiety being great among the growers of Conifers to obtain a plant of the “Mammoth Tree of California,” as it was familiarly termed. Hence the many specimens of about the same age, planted in 1856 or 1857, met with in nearly every collection in the country. In deep, light, rich soil and sheltered but airy situations its progress has indeed been remarkable, even among the many rapid-growing Conifers of the newer kinds which so deservedly occupy a place in our parks and pleasure-grounds. Should it never produce timber fit for any economic purpose besides firewood, it must hold a permanent place among handsome trees of the greatest utility and beauty for purposes of adornment. To show the universality of the *Wellingtonia* in this country, it may be stated that it is mentioned, and details of a specimen given, in 86 out of the 98 returns from all parts of the United Kingdom which are to be found tabulated at p. 481, the Douglas Fir alone coming near it in 84 returns. The tallest *Wellingtonias* mentioned in the returns are: In England, at Linton Park, Kent, it is 72 ft. high and 10 ft. 6 in. in girth, the thickest stem recorded in England; at Studley Royal, Yorkshire, 72 ft. high and 8 ft. in girth; at Orton Longueville, Huntingdon, 70 ft. high; at Penrhyn, Carnarvonshire, 70 ft. high; at Revesby, Lincolnshire, 65 ft. high and 8 ft. 8 in. in girth; at Chetwynd Park, Shropshire, 65 ft. high and 8 ft. 6 in. in girth; at Howick Hall, Northumberland, 60 ft. high and 9 ft. in girth; at Stackpole, Pembrokeshire, 60 ft. high and 8 ft. 6 in. in girth; and at Pampisford, Cambridgeshire, 60 ft. high and 4 ft. in girth. In Ireland, at Shanbally, Tipperary, 70 ft. high and 8 ft. 6 in. in girth,

growing in deep soil, in a sheltered glen, at the foot of the Galtee Mountains; at Castlewellan, Down, 69 ft. 6 in. high; at Coollattin, Wicklow, 64 ft. high and 8 ft. 6 in. in girth; at Woodstock, Kilkenny, 60 ft. high and 6 ft. 4 in. in girth; at Fota, Cork, 60 ft. high and 5 ft. in girth; and at Killarney, Kerry, 55 ft. high and 12 ft. in girth, this being the thickest stem of a *Wellingtonia* in Ireland. In Scotland the tallest is at Murthly, 66 ft. 3 in. high and 9 ft. 3 in. in girth, and a second tree, several years younger, and raised from a cutting at Murthly, is 61 ft. high and 6 ft. 6 in. in girth; at Rossdhu, Dumbartonshire, 65 ft. high and 11 ft. in girth; at Whittinghame, East Lothian, 64 ft. 6 in. high and 7 ft. 9 in. in girth; at Castle Leod, Ross-shire, 61 ft. 2 in. high and 10 ft. 3 in. in girth—a grand tree for that northern latitude; at Methven Castle, Perthshire, 61 ft. high and 7 ft. 5 in. in girth; at Scone, Perthshire, 60 ft. 6 in. high and 7 ft. 4 in. in girth; at Buchanan, Stirlingshire, 60 ft. high and 9 ft. 8 in. in girth; and at Castle Menzies, Perthshire, 52 ft. high, with the great girth of 13 ft. 9 in., the thickest stem in all the record, and probably not exceeded by any other *Wellingtonia* in Britain. Most of the specimens are in vigorous health, and growing fast, and promise to retain their handsome appearance for at least another generation. The *Wellingtonia* is so easily raised from seed and cuttings, that a succession of handsome, young, and vigorous trees can always be had for decorative purposes, or to replace those that have become unsightly from age or other causes. The wood is soft and very light, and may prove useful for certain work, although it does not, thus far, seem to be very durable; but no definite opinion can yet be expressed as to its real value for economic purposes when grown in the British Isles.

We have now passed in review the principal species of the newer Coniferæ which, from the experience already gained of their hardy nature and free growth in our soil and climate, are worthy of a wide and prolonged trial in this country as forest or economic trees. Their real value for commercial purposes cannot be accurately estimated until the trees have reached their full maturity and their products can be put into the market in their best condition. This may take another century with some of them, but enough has been shown in the returns which have been quoted, that a fair proportion of them will

in the end prove an unqualified success in Britain, and form a permanent addition to our forest trees of the greatest value to the country.

II.—CONIFERS AS ORNAMENTAL TREES AND SHRUBS.

In this section we have a much wider range of subjects to deal with, including most of the trees already enumerated, which, particularly when in a young and well-furnished state, are very beautiful and extremely useful as ornamental plants. The ornamental character of Conifers generally, and their special merits as decorative subjects, are, however, so well known and highly appreciated that it is unnecessary to dwell at length on the details of every species of beautiful and handsome tree or shrub, even should the limits of a paper of this nature permit it, and a short summary will suffice for showing their value in the British Islands.

Their beauty of outline and graceful habit specially qualify a great majority of the hardy species for the adornment of the gardens, lawns, and pleasure-grounds around country mansions; and as many of them are in harmony with rich architectural embellishments, they find an appropriate place in the neighbourhood of the most elaborately designed mansion with its terraced gardens, costly statuary, and richest works of art. For such positions the more formal and shapely Conifers are chiefly employed; and whether they be few or many their effect is always charming and attractive, so long as their natural outlines are not disfigured by the hand of man in attempting to give them unnatural forms. The compact and upright-growing varieties of Cypress, Juniper, Thuya, and Yew are chiefly employed for this purpose; but occasionally a Cedar, Pine, or other "bonnet" or flat-headed Conifer, is used with excellent effect. In the decoration of the flower-garden a great variety of Conifers in a small state are found suitable and of great value, either as single specimens arranged in formal order to set off the design, or in massed numbers to fill the beds in winter, or when more permanency is required than the ordinary flower-garden subjects afford. Here the dwarf and richly coloured varieties of Biota, Cypress, Juniper, Retinospora, Taxus, Thuya, and Thuyopsis are

found most valuable for planting in beds ; and the larger varieties of these genera, especially those of a distinct colour and erect form, along with the choicest kinds of dwarfish habit of the Firs, Pines, and Spruces, are used as single specimens to complete the design, and to give a well-balanced and harmonious effect to the whole space.

On the lawns, and in the pleasure-grounds at a greater distance from the mansion, almost every hardy Conifer is of value as a decorative tree or shrub. Space is there found for the most gigantic specimens of tree-life, and at proper distances apart the biggest of them may be grown with good effect, if the tree is naturally of a handsome contour, such as the *Wellingtonia*, and remains so for the greater part of its lifetime. A selection for this purpose need not be named, because all ornamental Conifers are eligible ; but in this division room should always be found for a specimen or two of the rarer and more interesting Conifers which are not sufficiently hardy and robust to grow everywhere, such as *Abies bracteata*, *A. Pindrow*, *A. religiosa*, and *A. Webbiana* ; *Athrotaxis*, *Cephalotaxus*, *Cryptomeria*, *Cunninghamia*, *Dacrydium*, *Fitzroya*, *Saxegothæa*, and *Taxodium* ; various species of Cypress, Juniper, *Libocedrus*, *Pinus*, *Podocarpus*, and *Torreya* ; and especially the curious and interesting Golden Larch (*Pseudolarix Kämpferii*), Maidenhair tree (*Ginkgo biloba*), and Umbrella Pine (*Sciadopitys verticillata*). Nor should we omit to mention here the later introductions of Fortune, Veitch, and others from the Far East, as most of the "Japanese" Conifers have proved to be perfectly hardy in Britain and are thriving well in our soil and climate. Among them are many valuable decorative trees and shrubs admirably suited for the lawn and pleasure-ground, and some of them are promising to grow into useful forest trees in course of time.

All of the larger and vigorous-growing Conifers are invaluable to the landscape planter for the embellishment of parks and policies. When disposed with skill and taste over a domain, in avenues, clumps, or single trees, they give a charm and freshness to the landscape, especially in the winter season, that at once attracts interest and admiration, and which no other trees can supply in our climate. The *Araucaria*, Cedars, Firs, Pines, Spruces, and the *Wellingtonia*, as well as the taller

Cypresses and Thuya, furnish a great variety of form and colour that is of the highest value to the landscape artist.

For many other purposes of an ornamental and useful nature Conifers are found to be of great value, such as the Cypress and Yew in churchyards and cemeteries ; the Arborvitæ, Cypress, Pine, Spruce, and Yew for evergreen hedges, screens, and shelter ; and especially for memorial trees, for which a few of them are eminently adapted. For the latter purpose, the selection of the species of Conifer for a particular spot and occasion is a matter which should always receive the most careful consideration, so as to have an appropriate kind, and the most durable tree that it is possible to select.

In fact there is scarcely a purpose for which trees and shrubs are employed in Britain for which Conifers are not of value. The most conspicuous purpose for which Conifers are *unsuitable* is for planting in large towns, although even in them the Cypress, Yew, and that *noli me tangere*, the Araucaria, if once well established, will flourish amid the dust and vitiated atmosphere for a considerable time. Still, Conifers are not subjects to be recommended for planting in such places ; nor are many of them at all adapted for planting in an arid climate and parched soil.

In conclusion, allow me to impress on this influential meeting the importance of giving the newer Conifers, of which we have been treating, a well-balanced position in all planting operations, neither overdoing the matter by planting them under all circumstances and for every purpose, nor totally neglecting them because of a single failure, arising, probably, from ignorance of the nature of a new species or other causes, which skill and perseverance can and will overcome. With a judicious use, most of the hardy members of the coniferous family are *valuable* in the British Islands.

THE QUALITY OF CONIFEROUS TIMBER AS AFFECTED BY SYLVICULTURAL TREATMENT.

By W. SOMERVILLE, D.Æc., B.Sc., F.R.S.E., F.L.S.

WHILE all acknowledge that much may be done by careful seasoning and the use of suitable preservatives and antiseptics to increase some of the valuable properties of timber, it is probably not so generally admitted that the quality of timber may be materially influenced by the conditions under which the trees exist in the forest. To anyone who is not intimately acquainted with the anatomy of wood and the laws of growth, it does indeed seem scarcely possible that anything the forester can do for growing trees will have any material influence on the *quality* of the resulting produce, however much his method of treatment may affect the *quantity* of the yield. It is too often supposed that Spruce timber, for instance, is just Spruce timber no matter whether it is yielded by trees scattered singly through a park or by those that have stood in dense masses in a close wood; no matter whether the soil is good or bad, or the elevation low or high. This view appears to receive strong support from the fact that our home-grown supplies, drawn though they be from plantations that have been constantly under careful supervision, are entirely neglected by architects of high-class structures in favour of material that has been yielded by primeval forests where the management has been entirely left to nature. That this is the case there is no denying, for our foreign imports of timber are nearly all drawn from the great natural forests of North America, the North of Europe, and other parts of the world; but it does not follow on that account that man cannot improve upon nature. A great natural forest that has been uninterfered with by man's hand teaches much that may be profitably imitated and much that may be advantageously avoided. Our imports testify as to the high quality of much of the timber produced under such circumstances; but the cost, although it appears to be nothing, is really out of all proportion to the returns. When the lumbermen invade the primeval forests and find trees two to three hundred years old,

rising tall and straight, and so close that not a ray of direct sunlight ever reaches the ground, they indeed find a rich harvest awaiting their axes ; but while they reap the hundred and fifty or two hundred trees that stock an acre, they are apt to forget the many thousands that originally grew there, but have succumbed and crumbled into mould in the struggle for existence. Under an artificial system of silviculture these thinnings would have gone to form the intermediate returns, which may amount to 50 per cent. or more of the whole ; so that, although their loss may not seriously affect the quantity or quality of the *final* felling, it will very materially influence the gross financial returns.

Provided a natural forest consists of trees all of the same age, and is felled before heart-rot has appeared in the trees that have survived, the quality of the timber forming the final yield may be of the very highest class ; and, if we neglect the intermediate returns, it could hardly have been improved upon by the most careful silvicultural treatment. But, in reality, such a state of things seldom, if ever, occurs. The magnificent timber that reaches this country from the great virgin forests of the Old and New Worlds forms but a small proportion of the material actually found there. Many of the trees are so much decayed as to be entirely useless, others are rotten at the heart for many feet from the ground, and only the upper two-thirds or so is fit for shipment ; so that the timber yielded by a given area may not represent one-half of the total quantity of material found on the ground. Nature is generally extremely prodigal of her gifts. Of the thousands or, it may be, millions of seeds produced by a tree during its lifetime only a very few find themselves in circumstances favourable to development ; whereas had the seeds been carefully harvested, and then sown and tended in a piece of ground specially prepared for their reception, man's intervention might have been the means of enabling the greater number of the seedlings to surmount the dangers common to youth and develop into stately trees. It is very much the same with regard to the timber. When nature is the forester she can and does furnish much that can satisfy human wants, but at what a cost the confused heaps of useless stems that mark the trail of the woodmen eloquently testify.

In considering the effect that scientific silviculture may exert

on the quality of timber, the first question that seems naturally to arise is : Has the source or origin of the seed anything to do with the character of the trees? This question has often been discussed by British foresters at the meetings of the two great arboricultural societies, but the scope of this paper prohibits our doing more than briefly glancing at some of the points raised by such a question, important though they are when viewed in the light of the whole subject of forestry. For instance, scarcely any belief has gained such universal acceptance amongst our foresters as that the Larch-disease is fostered and intensified by the propagation of young trees from seed gathered from diseased parents. I believe, however, that this view is held only by those who ignore the fungoid character of the Larch-blister. To prove that there are any good grounds for holding such an opinion it would be necessary to demonstrate the existence of mycelia or spores in or on the seeds, and this, so far as I am aware, has never been done. Whether, however, Larches raised from the seed of parents enfeebled by the ravages of *Peziza Willkommii* inherit the debilitated constitution of their parents, and so become predisposed to infection, must for the present remain a debated question ; but in view of the fact that it must take many generations to give rise to any considerable modifications of structure favourable to the attack of the parasite, it is hardly to be expected that this has anything to do with the rapid spread of the disease in our woods during recent years.

Leaving out of account the influence of origin on the transmission of fungoid disease, there appears to be no room for reasonable doubt that the success of forestry may be considerably modified by the care that is bestowed on the selection of the seeds. Those that are gathered in an early district are certainly not suitable for culture in a late one, largely because the resulting trees are predisposed to unfold their leaves and shoots before the danger from late frosts is past, and suffer accordingly.

Very bad results have always attended the raising of trees in a dry climate from seeds that have been harvested from trees grown in a region where the atmosphere is never very far from the point of saturation. Where the atmosphere is moist, interchange between the gases that permeate the intercellular spaces of the spongy parenchyma and the outside air is encouraged by the stomata being large and the cuticle sparingly developed. The

modifications of structure that are favourable under such circumstances prove very disadvantageous in a dry climate, where the tendency for rapid diffusion of the moist gases in the tissues of the tree with the outside air must be checked by a thick cuticle and by small stomata. Trees, therefore, that are raised in a dry climate from seed gathered in a humid region are, in their early stages, very apt to suffer excessively from drought, and may die altogether, although, should they survive the period of youth, they may become acclimatised and adapted to their new conditions.

Many practical foresters lay considerable stress on the careful selection of the best-formed trees from which to save seed, and this appears to be at least a safe course to pursue. It is true that some entirely deny that the seeds of trees stunted by high elevation or poor soil produce seeds of like character. Others, again, point out that, even granted that they do, such trees will be overgrown very early in the life of a wood by the more vigorous trees, and as they are removed in the thinnings they do not affect the main yield. This is, of course, assuming that all the young trees made use of in forming a wood have not been raised from the seed of stunted trees, but that such seed has been mixed with other seed yielded by large and well-developed trees. In a plantation, and still more in a natural forest, the struggle for existence and the survival of the fittest can be very advantageously studied. Those trees which, owing to inherent qualities or injuries, or the accident of position, display lack of vigour in early youth are immediately overgrown by their more robust neighbours, and cease to take any further part in the history of the wood. The result is the same whether man interferes or not. If it is a virgin forest these weaklings simply die, decay, and disappear; while, if the wood is under artificial management, they are removed in the thinnings. During the whole existence of the wood there is a constant shedding-out process at work, the weakest individuals succumbing and the strongest surviving; so that at the end of a hundred years or so—and in the absence of abnormal disturbing causes, such as wind—the two hundred trees or so that occupy an acre represent those of the original number that were best fitted for the circumstances under which they were placed. In nature it is chiefly those trees that shed the seed from which the succeeding

generation will spring, and it seems but reasonable to expect that good results would ultimately accrue did man follow nature's example and only make use of seed from such trees also. There need be no difficulty in doing so where seed is gathered for private use; but unfortunately, in the case of professional collectors, there is a strong temptation to gather that which is most easily procured, and therefore—except where trees are felled—stunted trees with their low-reaching branches are objects of special attraction.

When young trees are planted out into the positions they are permanently to occupy, great care should be bestowed on the manner in which the operation is performed. I do not propose to describe the various methods and modifications of pitting and notching, but whichever system is adopted the planter should be careful to secure a firm support to the young tree on the side furthest removed from the prevailing winds. These, in this country, blow from the south-west, so that, if the trees be planted by notching, the slit into which the young tree is inserted should have a north-west to south-east direction; and, if pitted, the larger and firmer sod should be placed on the north-east side of the tree. In exposed situations especially, the neglect of this simple precaution will make it possible for the trees to sway backwards and forwards in the slit, and in the course of two or three years many will become semi-prostrated on the ground. Although afterwards their upper part may assume a vertical position, the basal portion will remain permanently crooked, and the value of the timber, especially of the thinnings, will be seriously reduced.

Where the ground is soft, more particularly in exposed situations, many young Conifers up to eight or ten years of age will be found to be much inclined by the wind, even when the precautions that I have just indicated have been observed; and it is therefore advisable that young woods should be attended to every two or three years, and any trees that are visibly swayed should be supported in an upright position by placing a large stone or firm sod behind them. If this work is attended to while the trees are still small, it will not be necessary to employ stakes, and indeed the trouble and expense attendant on their use preclude their employment when silviculture is conducted on a large scale.

The production of high-class timber is greatly facilitated by a considerable degree of closeness in plantations, especially at an early age. It is quite impossible to lay down any hard and fast rules on this subject, because everything depends on the species of tree and the character of the situation. What one should aim at in planting out the trees is that they should be placed so close together that their lateral branches will begin to touch and overlap in about seven or eight years. Where we are dealing with a quick-growing tree, such as the Larch or Scotch Pine, this state of things will be sooner attained (assuming that an equal number of trees have been planted on an acre) than in the case of such trees as the Spruce or Silver Fir. Similarly as regards the situation. If this is of superior quality—if the soil is deep, the elevation moderate, and the climate favourable—then, other things being equal, the trees grow more quickly, and begin to close in on each other sooner, than under opposite conditions. We thus arrive at the general rule as regards the number of trees that should be planted out on a given area: The more rapid-growing the trees are in youth, or the better the quality of the locality, so much the wider may the distances be that intervene between the young plants.

The advantages attending a complete shading of the ground and the lower part of the boles at a comparatively early age are many. It secures that the lower branches shall be killed while still small, and these, decaying and separating themselves from the stem at an early age, leave a clean bole and timber as free from knots as it is possible to have it. It is not enough that the branches should be killed merely, for if they remain adhering to the tree for a considerable number of years after they are dead they prejudicially affect the quality of the timber more than if they remained alive. The knots formed by living branches are in complete union with the wood of the stem, so that, when the tree is cut up into planks, or any other form of manufactured timber, they do indeed diminish the strength, but at all events they cannot easily be knocked out. On the other hand, when the base of a dead branch is enveloped by the wood of the stem, a loose knot is produced, which very often falls out owing to shrinkage, so that a hole is left in the beam or plank. It cannot be too strongly insisted upon that dead branches behave to the tree just as foreign bodies do. The effect of a dead branch

on a Larch-tree would not be changed were the branch suddenly transformed into oak or iron. Pruning is one way by which dead branches may be got rid of, but, on account of the labour involved, this method cannot be profitably adopted in dealing with trees on a large scale. It is distinctly an arboricultural as opposed to a silvicultural operation. The same good effects may, however, be secured by crowding the woods in youth, and so killing the lower branches while they are still of small dimensions. If this be attended to, the dead branches will not long remain attached to the trees, but, decaying, will soon drop off under their own weight.

The amount of crowding that will clean the stem of the Larch or Scotch Pine will not be sufficient to secure the same result in the case of the Silver Fir or the Spruce. This is owing to the fact that the leaves and branches of the latter trees will remain alive under conditions as regards light that would speedily prove fatal to those of more light-demanding trees. It is therefore less necessary to crowd woods composed of light-demanding trees, and not only so, but it would also be very bad practice to do this. In order to show normal development the crown of a Scotch Pine, for instance, must be in the enjoyment of more space, and therefore of more light, than such trees as the Silver Fir or Spruce. Investigations carefully conducted in Germany show that for a situation that suits the various species equally well, one may, at the age of thirty years, have 100 Silver Firs on an area that would offer sufficient growing space to only 91 Spruces or 64 Scotch Pines; while at the age of sixty years the proportions would be 100, 75 and 56.

Then, as regards the situation, more trees will find room on a certain area *for any given age* the less favourable all the conditions are for tree-growth. This follows from the fact that the poorer the locality so much the less luxuriantly will the individual trees be developed. Thus, in the case of the Scotch Pine (according to Weise), at the age of thirty years the number of trees on a given area of a third-class locality should be 100, for a second-class locality 75, and for a first-class locality only 47.

Not only does a considerable degree of closeness in woods tend to the production of timber with the minimum number and size of knots, but it is also the only practicable means at the

forester's command, where dealing with large wooded areas, of improving the shape or "form" of the boles. A perfect clear bole, so far as form is concerned, would be of the same diameter just below the crown and immediately over the surface of the ground—that is to say, it would be a cylinder. Although such a bole is very seldom met with, at least when of any considerable length, it is the ideal form that should constantly be kept in view. The more the bole of a tree deviates from the shape of a cylinder—that is to say, the more rapidly it tapers from base to crown—so much the more wood must be sacrificed as slabs in manufacturing the timber. Now, a very brief consideration of the laws of growth will show that in the sylvicultural treatment of woods the forester has the power of very considerably modifying and improving the form of trees. The material from which wood and other plant-tissues are formed comes down from the crown, and according as this nourishing stream is great or small so will the total amount of wood formed be much or little. If a tree occupies an isolated position, and possesses a large low-reaching crown, it will be able to produce so much formative material that the cambium at the base of the stem will be as well nourished, and be able to form as broad rings, as the cambium situated higher up. This being the case, it is evident that little if any improvement in form can be expected in such a stem. It may increase very rapidly in volume, but it will always retain a form that necessitates much waste when manipulated in the saw-mill. Trees situated in a wood where a proper amount of closeness has been preserved grow somewhat differently from isolated trees. In their case the crown is confined to the upper half or upper third of the stem, and the sun has free access to it only from above, instead of from all sides. The amount of formative material is thus considerably restricted, being sufficient to afford normal nourishment to the cambium near the source of supply—that is to say, near the crown—but being insufficient to satisfy the wants of the cambium nearer the base of the stem. The result in this case is that the stem increases in thickness at a greater rate immediately beneath the crown than at any point lower down, and so the tendency is constantly in the direction of improvement of form. Suppose the case of a Scotch Pine which at the age of thirty years, has a diameter of 12 inches at the distance of 4 feet above the surface of the ground, and of 3 inches

25 feet higher up. If, during the next forty years, such a tree forms rings of an average breadth of $\frac{1}{8}$ inch at the height of 29 feet, and of $\frac{1}{16}$ inch at the height of 4 feet, it follows that, when seventy years old, the diameter at the upper point of measurement will be 13 inches, while at the lower it will be 17 inches. Suppose, further, that during the succeeding forty years the breadth of ring at 29 feet from the ground averages $\frac{1}{16}$ inch, while 4 feet from the ground it is $\frac{1}{32}$ inch, it is evident that when the tree has reached the age of 110 years its diameter at the upper point of measurement will be 18 inches, while 4 feet from the ground it will be $19\frac{1}{2}$ inches. Regarded from the point of view of form, the ratio of 3 : 12 is not nearly so favourable as 13 : 17, nor is 13 : 17 so favourable as 18 : $19\frac{1}{2}$. All through the life of this tree the shape has been undergoing steady improvement, so that, in "squaring" the bole in a saw-mill, the proportion of wood wasted in slabs will be much less at the age of 110 years than it would have been at the age of seventy. For 30 feet lengths of planks or battens the wood sacrificed in slabs for each 100 cubic feet of manufactured timber, at the age of seventy years, would be about 108 cubic feet, whereas at the age of 110 years it would only be about 71 cubic feet.

Although in crowded woods the individual trees are smaller in size than in woods that have been kept opener, still the amount of useful timber in the former case will always be greater than in the latter, provided the crowding has not been overdone. By interposing an uninterrupted stratum of foliage between the sun and the earth, the maximum amount of light is made use of for the decomposition of carbonic acid gas and the formation of wood; whereas, if the stratum be broken, some of the sun's rays escape, and are lost so far as the production of timber is concerned. Suppose the case of any given area of land that can just afford space for the unrestricted growth of 100 trees fifty years old. If, instead of 100 trees, such an area had been stocked with any greater number, say 101, then the amount of material yielded by the stem and branches of each individual tree would be somewhat less, although the gross yield might have suffered no diminution. Suppose, further, that instead of having 100 trees on the area one had had 150, it is apparent that the opportunities for individual development in this case will be very much curtailed. But when the space for development is

restricted, the first effect is to diminish the number and size of the branches, while the annual increase in volume of the stem is much less affected. The consequence is that by judiciously crowding woods one produces a larger yield of timber, though possibly not in all cases a larger aggregate yield, if one includes both branches and timber. If the crowding be carried too far, then the yield of timber will begin to decline, because the vital functions of the trees are interfered with, but where the exact turning-point is will depend on situation, species, and age. To continue this subject further would lead us beyond the limits of this paper, but those desirous of further information may be referred to Professor Schlich's English adaptation of Weise's "Tables for the Scotch Pine," published by Allen & Co.

Not only does the right degree of crowding ensure the production of stems of the best form and timber comparatively free from knots, and therefore timber which is strong and easily worked, but it is now recognised to have a very powerful influence on the durability of timber. The capacity of timber to resist decay depends largely upon the proportion of each wood-ring occupied by the dense autumn-wood; that is to say, the more this portion of the ring is developed, and the less the zone of spring-wood is represented, so much the higher will be the quality of the timber. The spring-wood, so called, is chiefly formed early in the growing season, while the autumn-wood is formed later, and if by any means the commencement of the formation of wood can be delayed, the production of spring-wood is kept in check, and the zone of inferior wood in each annual ring is represented in relatively small proportion. By delaying the period of the commencement of activity in the cambium cells, the total breadth of the annual ring will be less than it would otherwise have been, but the average quality of the wood will be very considerably higher. There seems little cause to doubt that this is the reason why coniferous timber with narrow rings is generally of such superior quality to wood of rapid growth. The period at which the cambium will become active is chiefly regulated by temperature, so that if there is a deficiency of heat in late spring or early summer the commencement of growth will be delayed. This will be most likely to occur:

- (1) In northern latitudes; hence the reason of the excellent

quality of coniferous timber produced in the North of Europe and in Canada.

(2) At high elevations, and so the popular belief in the good quality of the timber of cone-bearing trees grown in mountainous regions receives confirmation.

(3) In close woods, where the dense umbrage excludes the sun's rays. Professor Hartig's researches bring out very strikingly the superior quality of coniferous timber yielded by dense woods, as compared with that produced by isolated or semi-isolated trees. His views, as set forth in "*Das Holz der Nadelwaldbäume*," are shortly as follows. Where the stems of Conifers are well protected from the sun's rays the cambium does not become active for about three weeks after growth in thickness has begun in similar trees whose stems are not thoroughly shaded. This delay carries the trees over the period of the year when the conditions are unfavourable for the production of cells with thick walls and small lumina—that is to say, the period when much of the spring-wood is formed. He maintains that the inferior character of the wood produced early in the season of growth is entirely due to the want of a sufficiency of nourishment to thoroughly lignify the young wood-cells. If the cambium cells have been stimulated into activity by heat, they are forced to divide to form new wood, but the wood then formed is very deficient in lignine, and is therefore lacking in durability. But if the temperature is kept below the stimulating point, and the cambium cells remain inactive till after the unfavourable climatic conditions of late spring or early summer are past, then, according to Hartig, when the formation of wood does begin it can proceed under circumstances favourable to the production of improved quality. By that time the days are longer, the skies less clouded, and the weather more genial, and consequently, assimilation being more active, the cambium and young wood-cells are well provided with formative materials.

Not only is it very desirable that the boles should be well protected from the sun's rays, but also complete shading of the surface of the ground is one of the first principles of modern silviculture. This prevents grass and other forest weeds from covering the ground and diminishing the amount of water at the disposal of the trees. A covering of herbaceous ground vegetation also retards the rapid accumulation of humus which tends so

largely to raise the fertility of a forest soil. Anything that reduces the fertility of the soil at the same time lowers the quality of the timber, for the more plant-food there is available, so much more the lignine will be formed, and so much the better will the timber be able to resist decay. Although narrow-ringed coniferous timber is usually of higher quality than that which has broad rings, this is by no means a universal law, and only holds good when slowness of growth is due to retardation of cambium activity owing to temperature, but never when slowness of growth is due to poverty of soil. Other things being equal, the best timber—dicotyledonous as well as coniferous—is produced on the best soil, and anything that prejudicially affects the fertility of the soil will react on the quality of the timber.

In the case of light-crowned and light-demanding trees, such as the Larch, it is impossible to crowd the woods sufficiently to secure the full results of the beneficial effects of shading on the boles and ground, and so resort should be had either to under-planting, or to even-aged mixing with some dense-foliaged or shade-bearing tree, which will impart the beneficial effects of shade while allowing the Larches to be kept sufficiently thin for successful growth.

In order to produce high-class timber, silvicultural operations require to deal with wooded areas of considerable size. It is quite hopeless to expect much return in timber from narrow strips of trees planted for ornament or shelter. Such woods may give a large return by beautifying a landscape or sheltering agricultural or pastoral land, but it is asking too much to demand a rent from the land in the shape of forest produce as well. If a belt of trees is designed primarily for purposes of shelter, it should be managed from the first with a view to securing this end, and the production of timber should be a subject of quite secondary importance. If a narrow strip of trees is to yield permanent shelter, it must always be kept so thin that the trees shall interfere with each other as little as possible. Only in this way will the lower branches, which are most instrumental in breaking the force of the wind, be preserved alive, and the trees be induced to provide themselves with a plentiful supply of roots to withstand violent gales. At once we see that a shelter-belt must produce extremely coarse timber. If the attempt is made to secure shelter and good timber, then it is quite certain that dis-

appointment will be the result. If the trees are kept so close together in youth as to enable the boles to clean themselves, then, of course, shelter is sacrificed at a very early age, and in middle-age the wind will blow through amongst the bare stems with scarcely impeded force. In any case, if the situation is at all exposed, the trees in a narrow belt are of insignificant dimensions, being especially deficient in height. Even in a large wood one can see that a considerable breadth on the windward side does not contain trees of such large dimensions as are to be found further in. This part is, in fact, a shelter-belt for the rest of the wood, and should be treated accordingly. Although it may not yield a full return in timber, it is fulfilling a most important office in protecting the rest of the wood from biting winds and violent gales. No attempt should be made to improve the timber by pruning the outer row of trees. Their coarse gnarled branches and short rugged stems best fit them for acting the part of advance guards and of bearing the first brunt of the storm.

In the foregoing remarks I have endeavoured rather to stir up interest in the subject of this paper than to treat it exhaustively. In our present state of knowledge, indeed, this would have been impossible, for there is still much to learn regarding the conditions of growth that affect the quality of timber. But what we do know we should at least apply in practice; and, in view of the somewhat unfavourable reputation attaching to home-grown coniferous timber, it would appear to be for our interests to embrace every opportunity that holds out the prospect of improvement in quality.

THE TIMBER OF EXOTIC CONIFERS: USES AND COMPARATIVE VALUE.

By Mr. D. F. MACKENZIE.

THIS subject embraces such a wide field for discussion that to enter particularly into every detail would involve an amount of description which to most people would seem uninteresting and

superfluous. I shall therefore confine my remarks to the timber of some of the most tried trees, apart from many of those of early introduction already so well known as to require no mention here—amongst the most prominent of the latter are the Larch, Silver Fir, and Norway Spruce, three most valuable trees in this country—and those of later introduction, of which little is known of the value or quality of their timber.

It may be taken for granted that it is now beyond question that many parts of this country, especially Scotland, are exceedingly well adapted for the profitable growth of many of the exotic Conifers, the variety of soil and diversity of climate giving us a great range of natural adaptation—our deep, narrow dells and glens contrasting very favourably with the natural habitat of several of the varieties after named. But we must not expect that we can ever produce timber of the same size and quality as that produced in the true and natural home of the trees enumerated below. Yet it is not too much to expect, judging from the examples found in Scotland and elsewhere, that with proper selection of soil, situation, exposure, and climate, four necessary conditions, we can greatly improve our timber supply, if not in quality at least in quantity, although it is to be regretted, for many reasons, that quantity takes precedence of quality. A large volume in a given time is really what is wanted since iron beams have taken the place of those of timber.

Whatever opinions may be entertained by experts or by persons having only a very limited knowledge of timber as to the commercial value of many of our exotic Conifers, compared with the native variety and those of early introduction, I have by using the timber proved to the satisfaction of all who have seen the timbers in use that they are very valuable indeed, both in regard to colour and beauty of “grain” as well as durability.

The data for comparative value I have taken from over forty thousand measurements, and by giving a well-known tree, the Scotch Fir, as a standard of value, the values of all are easily arrived at. For example, Scotch Fir at 100 gives Larch a value of about 216, and with this in view I shall fix the standard of average value of Scotch Fir at 100 per unit.

Taking the old nomenclature,* I begin with the beautiful

Abies Albertiana.—The timber of this tree is valuable on

* For correct names and synonymy see Dr. Masters' Synopsis, p. 179 *et seq.*

account of its elasticity. It is quite equal to the Larch, and not unlike the wood of that tree, though as yet its durability in contact with a moist soil has to be proved. Except in that case, what is known of the timber of this tree grown in this country proves it to be valuable. The wood is of a yellowish-white colour, fine-grained, and takes a good polish; the saplings make first-class ladders for slaters, plumbers, and the like, much lighter and stronger, and in every way more reliable, than the Norway Spruce. Value 200.

Abies canadensis.—The wood of this tree resembles the foregoing generally; is less elastic, but better adapted for house-fittings. The wood when old is hard, fine-grained, and stains dark brown under treatment with French-polish or varnish. Good for railway-line posts and housework. Value 75.

Abies Douglasii.—The timber of this valuable tree resembles very much that of the Larch, though not so very strong or heavy as that timber, owing no doubt to its very rapid growth. It is capable of being profitably used in all works in which Larch is used, except for boat skins, riddle and basket making. The wood is extremely easy to work, and when dressed does not warp and twist like the Larch. It takes varnishing well, and polishes to a rosy-brown colour. There is little doubt that wood from trees well matured by age will be quite equal in every respect to that of the Larch, and can be used in all architectural work where the yellow and other Pine timber could be used, and with much better effect owing to its colour. For Gothic roofing, principals, purlins, and sarking it cannot be equalled. Value 225.

Abies Menziesii.—The timber of this tree at first sight resembles the common or Norway Spruce (*Abies excelsa*), but a closer acquaintance prove it to be a much more valuable wood than the latter, being tougher and much easier worked. The common uses of the wood are roofing and fittings of agricultural and other buildings, and for lining rooms on the "lap joint" system. Massive dining-rooms, studies, &c., done with this wood are extremely beautiful, and examples of the work are to be seen in the Birnam Hotel, near Dunkeld, and several of the best houses on the Murthly property. The wood is easily worked, though similar to common Spruce, and is suitable for piles, aqueducts, staves and headings for dry-goods casks, as also packing-cases, and where closely grown is suitable for herring-barrels. Value 220.

Abies Morinda or *Smithiana*.—In appearance the timber of this tree is a facsimile of that of *Abies Menziesii*, but with this difference, that the tree being much slower in growth, the timber is harder and more brittle. The wood does not appear to possess valuable qualities, being of less value than that of the *Abies excelsa*. Value 55.

Abies orientalis.—The wood of this tree as grown in this country resembles very much that of the black American Spruce (*Abies nigra*), but is much more valuable on account of its toughness and durability. The "grain" is very marked by the autumn growths being so dark in colour and that of the earlier part of the season white. Having only seen one log of Scotch-grown *A. orientalis*, I am not able to give any particulars. It is not a fast grower, but the wood has the appearance of being valuable. Value 75.

Araucaria imbricata.—The wood of this tree when aged is extremely hard and fine-grained. The heart-wood is of a rich brown colour; it polishes well, showing beautiful silky shades, owing to corrugations in the growth. Under certain treatment it appears like the American Birch in figure, except that the Pine lines are seen in both the end and longitudinal sections. The timber ebonises well, and, besides the common uses of Pine timber, it is adapted for various articles of furniture, and is easily worked. Value 140.

Cedrus atlantica.—The timber of the Mount Atlas Cedar is so well known that describing it may be out of place. The wood is very fragrant, beautifully marked, and polishes well. It is highly suitable for bedroom furniture and linings of drawers, cabinets, sideboards, and the like, but the chief use to which it should be applied is flooring for bedrooms. No moth will venture near where this wood is used, and no carpet would be required. It diffuses an agreeable odour, which is believed by some to have a slightly narcotic effect and to be beneficial to health. Value 144.

Cedrus Deodara.—The same remarks apply to the use of this wood and other particulars. Without the aid of the microscope it is impossible to distinguish the wood of the one variety from that of the other, they are so similar in every respect. The timber of the three Cedars (*atlantica*, *Deodara*, and *Libani*) is very similar, and one may be sold and used as any of the three trees. The value of the *Deodara* is about 142.

Cryptomeria japonica.—The timber of this tree is of a beautiful red colour, strongly scented. The wood is very suitable for the same purposes as the foregoing Cedars; makes beautiful architraves, panel-frames, mantelpieces, and flooring. It is light and very tough, but easily worked. Value 180.

Cupressus Lambertiana.—This tree produces very valuable timber, having an agreeable odour. It is suitable for many purposes, but its chief uses are furniture and the fittings of the best classes of dwelling-houses, drapers' shops, and the like. From its lightness, hardness, and, beautiful colour it is altogether a most desirable wood, and, being a rapid grower in favourable situations in this country, is valuable as a forest tree. Value 288.

Cupressus Lawsoniana.—The timber of this tree is also of fine quality and strongly scented. The wood, which is easily dressed, is elastic and of a yellowish-white colour. My experience of this timber is very limited, but, judging from the little I have gained, I think it will be a useful and lasting timber. Its commercial value is about 120 to 185.

Cupressus macrocarpa.—To the unaided vision the wood of this Pine is in every way similar to, but having a little more density than, that of *Cupressus Lambertiana*. The same remarks apply to this timber as to the latter. Value 190.

Libocedrus decurrens.—Why this is called "White Cedar," while its timber is nearly as red as that of the Californian Redwood, one is at a loss to understand. In a young state the timber is of a yellowish-white colour, but the heart-wood, which begins to form usually about the eighth year, is of a mahogany-red colour, strongly scented; strong, elastic, durable, and easily worked. It is highly suited for furniture, for finishings for superior houses, and for shop fittings, as well as for the commoner uses for which Pine timbers are adapted. Value 110.

Picea grandis (Douglas).—A tree producing timber superior in quality to that of *Abies Douglasii*, but less in quantity in a given time. The timber is very white, elastic, and easily worked. It is suited for most purposes for which Pine timber is used—scantlings, beams, and general roofing and flooring. In general appearance the timber of this tree is somewhat unique. Value 160.

Picea lasiocarpa (Lobb).—This tree produces timber more

dense than the foregoing, of the same colour, but having larger knots and more inclined to heart-colour earlier than the *grandis* of Douglas. It does not, in my experience, produce nearly the same amount of timber in a given time as that tree. Value 140.

Picea nobilis.—A tree producing harder timber, but quite as easily worked as either of the foregoing. It is durable, and when well seasoned is hard and light, eminently suited for architraves, panelling, and framing for doors, windows, and the like. In the young state it is not to be recommended for flooring, as it is apt to get “scooped” out between the growths, leaving narrow ridges like corduroy. Its value is about 170.

Picea Nordmanniana.—This tree is of much slower growth than the tree last named. The timber has the same appearance, but is harder and apparently more durable. In one or two instances the timber shown to me resembled very much that of a fast-grown *Picea pectinata*, but timber from trees I have known had very little resemblance to the wood of that tree, especially the heart-wood. The timber is useful for any purpose for which ordinary Pine is adapted. Value 125.

Picea Pinsapo.—The wood of this tree does not appear to be very valuable. It is difficult to work, very brittle on account of the numerous knots, and rots quickly when in contact with the soil. This and the timber of *Picea cephalonica* and *Picea numidica* resemble one another so closely that it is almost impossible to distinguish the one from the other. Value 96.

Pinus austriaca.—The timber of this tree is well known to most people. It is coarse-grained, tough and durable, but considerably inferior to the Scotch Fir. Value 70.

Pinus Cembra.—From the slow rate of growth, the timber of this tree is of very good quality as a rule, being hard, even-grained, easily worked, and very durable as flooring, scantlings, window and door framing. Its value is about 60.

Pinus excelsa.—The timber of this tree is coarse and soft, easily broken, and not very durable. The wood is faulty through the numerous “pools” of resin throughout the entire structure, induced, no doubt, by the ulcerated condition of the bark, a disease to which this tree seems especially liable. As to bulk of timber it is about equal to Scotch Fir. Value 100.

Pinus Jeffreyi.—This tree produces valuable and durable timber, very regular in growth, though rather soft while in

the young state. It produces heart-wood rapidly, and thereby becomes valuable for any purpose to which Pine timber may be applied. Its value as to timber and quality is 140.

Pinus Laricio.—A well-known tree, fairly fast grower, wood soft at first, but very hard when matured, durable and easily worked. The wood is quite suitable for every purpose for which the timber of the best Pine is used, and its comparative value is about 125.

Pinus monticola.—The timber of this tree is valuable both from the great bulk produced in a given time and from its elastic quality. It is easily worked and stains beautifully. The wood is light, tough, and durable, but liable to the depredations of moths. It produces wood highly suitable for house furnishings, for which purpose it should be cut in winter, to lessen its liability to attacks by moths. Its value as compared with Scotch Fir is 210.

Pinus ponderosa.—The tree produces what may be called dense, heavy-grained timber. The heart-wood is full of resin and of a yellow-brown colour, the autumn growth being marked by a very distinct line of a dark Spanish-brown colour, which gives the wood a character of its own. The timber is exceedingly well adapted for piles for jetties, embankments, &c., flooring, joisting and roofing; but probably railway sleepers, for which it would excel the best Larch in point of duration, would be the chief market for the timber. It is difficult to work, oil being constantly required for the tools in working. The few specimens I have had cut up exceeded in specific gravity anything I have seen in the Mar, Rothiemurchus, Nethy or Dulnain forests of thirty years ago. It promises to be a very valuable timber when at full maturity. Its value is about 125.

Pinus pyrenaica.—A tree producing timber similar in appearance to *austriaca*, but finer grained, more elastic, and better adapted for general purposes. Value 75.

Pinus rigida.—Like the *Pinus ponderosa*, the timber of the *Pinus rigida* is heavy and full of resin, and in other respects very similar, being durable, and useful for the same purposes, and equally difficult to work. So far as I have had opportunity of observing the growth, it is slower and more formal than that of *Pinus ponderosa*. The value is 95.

Sequoia (Taxodium) sempervirens (the Californian Red-

wood-tree) produces beautifully coloured wood, suitable for many purposes, chiefly shop and house fittings, panelling, dados, picture-frame and mirror backs, mantelpieces, &c. The colour under French-polish is a rich "porty" brown, having, however, the Pine markings quite distinct. The timber is not very durable in contact with damp, but as it absorbs oils very freely it can be made lasting at pleasure. Like the Kauri Pine, it is well adapted for carriage panels, and forms beautiful work when used with Butternut (*Caryocar nuciferum*). In any of the home-grown specimens I have seen or have cut up I have not observed any "curly" wood, but no doubt time would produce that figure in the home as well as in the foreign article. For bulk as well as for beauty of timber this tree is very valuable. As compared with Scotch Fir its value is 204.

Wellingtonia gigantea.—The timber of this tree resembles in colour that of the foregoing; it is, however, more porous, lighter, not so durable, and fractures more easily. It is very liable to be attacked by fungi, but withal is a very good timber, and is chiefly suitable for the same purposes as the *Sequoia sempervirens*, and for any of the purposes for which Pine timber is adapted. The growth alone gives a value of 370 as compared with Scotch Fir at 100.

It will be observed that I have omitted many very useful trees from the above list. Had I been writing a theoretical paper on the subject, I should probably have doubled the number, but I have confined my remarks to the timber of such trees as are well known to myself—trees the timber of which I have had cut up and put into use. As must be well known, the timber was cut from comparatively young trees, not in any way matured by growth; at the same time they have been compared with the Scotch Fir, Larch, &c., of the same age and under the same circumstances. As to the comparative values, the figures given represent the conclusions arrived at by actual measurements and personal observation. While this is the case, I feel satisfied that in many cases the values I have given will fall far short of what the actual value will be when the trees arrive at maturity in this country. I have little doubt most of those trees I have named, and many I have omitted, will carry out the profitable rate of growth till maturity. If I am nearly correct in such an assumption, there is a great and profitable future in store for

those who will at once begin to plant on a large scale the trees named.

It may not be amiss for me to say a word about the planting of one or two varieties, because the success or otherwise of that operation has a marked effect on the quantity and quality of the timber produced.

If my advice were asked by the owners of large, or even small, woods and plantations that have become "blanky" through the injurious action of the winds and other causes—conditions very common in the woods throughout Scotland—I should at once advise the planting of these spaces with those beautiful trees *Cupressus Lawsoniana*, *Abies Albertiana*, and *Thuja gigantea*. I need not here enter into reasons for such advice further than to say that these trees of all others are pre-eminently suited for such work. For pitwood alone these trees are invaluable. In, say, twenty-five years an acre of these would be worth about £60, planted as above or even in forests by themselves. In this respect they would on a given area, in a given time, exceed the value of the best Larch. The great drawback at present is the cost of the plants. Unlike other commodities, however, demand in this case would cheapen the article.

What I advocate here about *Cupressus Lawsoniana*, *Abies Albertiana*, and *Thuja gigantea* is no mere theory. In 1886 I bought a quantity of the above plants, described in the catalogue as from 2½ to 3 feet, and a few *Picea grandis* (Douglas) 3 feet. I planted these where the winds of the previous winter had uprooted all the trees. At the present moment many of those plants are 16 feet high, having a diameter of over 6 inches at one foot from the ground, nearly every tree having a 6-foot length suitable for common pitwood. In some cases they are planted at less than 9 feet apart, in others more. Under the above treatment *Cupressus Lawsoniana* produces more timber than *P. grandis*, although the latter is quite as tall, but it will not bear crowding, while the other varieties will stand quite thickly together without harming each other. A quality possessed by the *Cupressus Lawsoniana* and the other two trees I have named is that crowding makes their timber of better quality, while the quantity produced does not seem to be appreciably diminished. The three are undoubtedly shelter-loving trees, and

should be treated as such in order to get the greatest possible bulk of timber in a given time.

I feel I cannot close this paper without recording a curious fact observed in the working of the various Pine timbers I have named. It was found that the wood of those Pines having three leaves in a sheath was, as a rule, much harder than that of those having only two, while all those having five leaves in the sheath were uniformly soft, and when dressed had a silky appearance. So general is this characteristic that one could almost at once tell to what class a certain plank of Pine timber belonged. The same rule holds good with the Abies tribe, the timber of the *true* Spruce, as represented by the Norway Spruce, being quite distinct in appearance in every particular from the pseudo variety represented by *A. Douglasii* and others. This distinction is also plainly visible in the timber of the Silver Firs, the variety represented by *P. Pinsapo* being quite like the timber of Spruce, while those represented by *P. nobilis* resemble the wood of the five-leaved Pines.

While these characteristics are pretty general, it is well known that soil, exposure, and elevation have a very marked effect on the figure, quality, and quantity of timber, so much so that it is difficult to get the "points" of character constant unless the trees are grown side by side and in masses.

THE DISEASES OF CONIFERS.

By Prof. MARSHALL WARD, M.A., F.R.S., F.L.S., &c.

I UNDERSTAND that it is my duty to bring before your notice as clear an account of the very long subject embraced under the above title as can be summarised in comparatively few words. The task is not an easy one for two reasons: firstly, because there are so many diseases from which Conifers suffer, and, secondly, because I cannot expect all my hearers to be well acquainted with the class of facts with which I shall have to deal, and from which generalisations must be drawn that lose

or gain in force (like all scientific generalisations) according as few or many well-established observations are borne in mind.

Speaking broadly, there are two great classes of diseases which imperil the life of Conifers. There are, on the one hand, diseases due to the more or less directly injurious action of other living organisms—animals and plants—which injure or destroy the roots, stems, leaves, &c., of the Conifer, and so bring about the death of the whole or of parts of it; and, on the other hand, there are dangerous physical conditions of the soil, climate, atmosphere, and so forth, which render the life of the Conifer more or less precarious, or even impossible.

As matter of fact, however, these two classes of dangers are frequently found acting together, and so a given case of disease may be complicated owing to the co-operation of many factors. In other cases it is found that the symptoms known to be characteristic of a particular disease are so closely simulated in diseases due to quite other causes than those which produce the primary malady, that confusion results, and barren lines of action are started by the practical man who fails to discriminate between the various cases.

Instances of this kind are so instructive that we may take as an example the well-known disease of Pines characterised by premature shedding of the leaves, as yellow and brown needles, which collect in dense heaps beneath the trees.

In some cases it is certain that the leaves of young Pines are cast suddenly, and in dangerous quantities, after a sharp frost, or at least after a night so cold that the still soft foliage is chilled below a point which we might call the death-point for these organs.

In other cases, however, similar leaf-casting occurs under conditions which are very different in their action. Young Pines suddenly lose their "needles" in warm sunny weather when the ground is frozen hard; or these organs fall in showers after a period of drought in a hot summer.

Now although the symptoms which preface and accompany the above cases of premature leaf-casting are in the main similar—the green leaves turn yellow, and then brown, and rapidly fall, shrivelling in heaps, to the ground below—the disease is a different one, and is caused by different agents in each instance, and it is even possible to obtain fairly obvious evidence of this.

In those cases where the fall is due to the direct action of frost, or of cutting cold winds—*i.e.*, where the leaves are killed by the sudden abstraction of heat from their tissues—keen observers have found that those basal parts of the “needles” which are enclosed in and protected by the sheathing-scales of the short branches (“tufts”) may remain fresh for some time after the exposed parts have turned brown and shrivelled up.

In the second class of cases, however, no such partial shrivelling of the leaves is seen; the tissues dry up all along the “needles,” from tip to base completely, and this is because they have been killed by drought—either because the roots in the frozen soil cannot supply water to replace what is being transpired in the bright sunshine, or because the weather is so hot and dry that there is not enough water in the immediate environment at all.

Different as are the above causes of premature leaf-casting, there are still others, of which the following is the most prevalent and difficult to deal with. The leaves turn yellowish, with brown and purplish spots and patches on them, and fall in showers as before; but this time the disease is found to be epidemic in character. Towards the end of the summer numerous tiny black spots may be observed on the dying and dead leaves, and these are the spermogonia of a definite fungus (*Hysterium Pinastris*, one of the *Phacidiaceæ* of the Discomycetes). In wet seasons, or if the leaves be kept moist through the winter, the higher fructifications and asci may be obtained.

Researches have shown that Göppert* was quite right, so long ago as 1852, in attributing this epidemic to the ravages of the mycelium of the above fungus; the hyphæ invade the leaf-tissues during wet seasons, kill the cells, and so bring about the browning of the “needles.” When large quantities of needles have been thus ruined, they suddenly fall in the showers which bring dismay to the forester and horticulturist, and give the name (shedding—*schütte* of the German foresters) to the disease.

These are not the only causes of premature leaf-casting in Conifers, but they are good examples of the commonest types, and I have brought them forward here to show you how very easy it is for anyone unacquainted with the facts to draw erroneous conclusions as to the causes of the phenomena; and

* “Verhandl. d. schlesischen Forstvereins,” 1852, p. 67.

it must be remembered that wrong conclusions—*i.e.*, wrong diagnoses—lead to improper treatment in plant-diseases, as they do in human diseases.

The diseases of Conifers are, in fact, like the diseases of other living beings, cases of disturbances in the struggle for existence going on among the structural elements of the tissues, &c.

My task to-day is confined to the discussion of only two categories of these diseases—those due to fungi, and those due to disturbing actions of the inorganic environment; * the simplest plan will be to take some of the groups of Conifers *seriatim*, and touch briefly on their prominent maladies.

I. THE PINES.

Owing to their very resinous nature, the Pines generally are not so apt to suffer from injuries which result from the exposure of open wounds as are many other trees, and it is astonishing how much knocking about the hardy species will endure; breakages from wind, heavy snow, the cutting and biting of man and other animals, and so forth, are readily healed over by occlusion† in the case of most of the species.

A very common cause of disease and death in Pines is the breaking of the ascending water-current from various actions of an unsuitable environment. Speaking generally, the Pines require light, open, and well-drained soils, as deep as possible;‡ and many aspects of disease in them are due to the non-fulfilment of these conditions.

Unquestionably one of the worst of these dangers results from the clogging of the soil at the roots, whether due to wet clay, stagnant water, the covering up or hardening of the surface—*e.g.*, by means of pavements, &c.—or other processes.

The general course of events is much the same in all these cases. The primary cause of the injury is want of oxygen at the roots, for without due supply of that gas in the water to which the living and absorbing parts of the smallest root-fibrils have

* Those diseases which are due to the injurious action of animals, especially insects, being treated of separately.

† I suggested this word in 1865 as a translation for the German *Ueberwallung*, and it has been accepted by my colleagues and others.

‡ We are not concerned with exceptions to this very general rule—*e.g.*, the Austrian Pine and others will *grow* on shallow and even rocky soils, and there is considerable latitude as to what particular Pines will *endure*.

access the cells of the latter cannot do their work. That is to say, the roots are unable to take up water, containing oxygen and mineral constituents in solution, at periods when the "evergreen" leaves are transpiring large quantities of vapour into the atmosphere. Consequently the young branches and tips of the tree may die off rapidly, and if the source of mischief is permanent the whole plant will die.

But the class of diseases due to "wet feet"—as it is often called—is even more complex than this. The persistent rotting of dead rootlets in a wet soil not only implies loss of root-power as above referred to; it also entails the direct consumption of oxygen and the fouling of the water by poisonous products of decomposition, which diffuse through the dying tissues to higher ones which were still healthy, and might have sufficed to supply new rootlets &c. had the state of undue moisture been merely temporary.

Moreover, the presence of excessive moisture, and heavy wet soils, prevent the necessary warming of the absorbing rootlets, and cases are not uncommon where the stiffness and moisture of a soil, though insufficient to cause the death of the absorbing cells by asphyxia—i.e., the deprivation of free and dissolved oxygen—or by direct poisoning, are still so powerful in preventing the necessary rise of temperature, which must take place before the absorbing living cells can obtain, and pass on, the proper supply of water, which the losses from the aërial parts of the plant demand, and by means of which the minerals needed can alone be furnished, that symptoms of death by drought make their appearance, the leaves turn yellow and then brown, shrivel and fall, and the tree may even die.

I have already shown you how a very similar state of affairs may be brought about when young Pines have their aërial parts exposed to dry air and hot sunshine, at a time when the soil is frozen hard, and the roots are rendered inactive by the low temperature of the ground.

The proper understanding of all these matters in detail requires considerable acquaintance with the microscopic anatomy and physiology of the plant, but anyone may readily gather the main points concerned, and will see that preventive measures can only be put into action intelligently and with hopes of success if these points are apprehended.

Obviously young Pines in beds should not be exposed to powerful insolation at a time when their roots are in hard frozen soil as above described, and in those cases where such dangers are imminent a piece of gauze or other shelter will reduce the chances of disaster.

Equally obvious is it that suitable drainage operations may make all the difference to a locality not quite fitted for growing such plants, and I want to take this opportunity of insisting upon the very important fact—which applies to other plants as well as Conifers—that the operation of drainage does not consist in merely removing superfluous moisture; far more important is the pressing into the interstices of the drained soil of atmospheric oxygen, which does so much work of various kinds in the labyrinth of passages which it traverses, that a whole lecture would not nearly exhaust the treatment of this subject alone. Another extremely pertinent point in this connection is that the drained soil can be warmed by the sun's rays, or by the higher temperature of the air referred to, not only more easily, but also more equably.

Other advantages of suitable draining are too well known to be dwelt upon. The dangers of improper or over-draining do not immediately belong to my present subject, but obviously they must be guarded against.

Passing now to the diseases due to unsuitable conditions in the sub-aërial and atmospheric environment, the following points may be considered.

Pines, especially when the foliage is young, and still more particularly when the plants themselves are young, are apt to lose many leaves, and even to be killed, by undue chilling of the surfaces, cold dry winds being perhaps the most fatal agents in this country. I have already referred to that form of leaf-casting which is caused by this; but it is perhaps commoner to see parts of the tree only, in the case of the more tender Pines, with their foliage brown and shrivelled, than to have a general fall of the leaves.

A curious class of diseases, not common in the Pines, perhaps, but stated as occurring in *P. Strobus* and some others with thin cortex, are the various kinds of "rifts"—i.e., more or less vertical fissures, which extend up and down the exposed trunks of trees facing the south-west. The particular kind of

rift here referred to rarely, if ever, appears in trees grown in the open from their youth onwards, but is very apt to occur on the south-west aspect if older trees previously closed up and well sheltered are exposed by a cutting. I see no reasons for rejecting the explanation that such rifts are caused by the direct rays of the sun beating on the thin cortex when the air is at its highest temperature; whether the cells are killed directly by the sun's rays, or whether the damage is due to excessive evaporation of their water, is as yet not certain.

I must be contented with the mere reference to these phenomena here, however, and with the remark that difficulty is experienced in distinguishing between these sun-rifts and other cases of splitting, or even wholesale desiccation of the cortex of the more tender Pines owing to sudden drought, frost, cold winds, &c., to which they may be suddenly exposed by the removal of neighbouring trees which sheltered them previously.

Of all the sub-aërial agents which damage Pines, however, none are perhaps more to be feared than the acid gases of our larger manufacturing towns. Sulphurous acid, hydrochloric acid, chlorine, coal-gas, and such-like chemicals are fatal to Pines even in very small quantities; and it is no doubt to these, rather than to the increased percentage of carbon dioxide, soot, or to the diminished light, that the foggy exhalations of large towns owe their enormous power for evil. Nor can we wonder at this when we reflect that many Pines are mountain species, growing normally in those purest of atmospheres which attract us for the very reason of their purity.

I now pass to the consideration of those diseases of Pines which are directly traced to the injurious action of fungi on or in their roots, stems, or leaves.

These fungi belong almost exclusively to the groups of parasitic Ascomycetes, Uredineæ, and Hymenomycetes. It is true that *Phytophthora omnivora* (one of the Peronosporæ) attacks and destroys the seedlings of these and other Conifers; but the rule is that Conifers are exempt from diseases due to the Peronosporæ, Ustilagineæ, Gymnoasceæ, or Gasteromycetes, and also from those caused by Bacteria (with one exception*) and Myxomycetes.

* Vuillemin, "Sur une Bactériocécidie ou Tumeur Bacillaire du Pin d'Alep," *Comptes Rendus*, November 26, 1888. It may also be remarked

A complete list of the parasitic fungi which injure the Pines would carry us too far, and I must content myself with the following selection of them.

Some of the most mischievous are *Trametes radiciperda* (*Polyporus annosus*, *Heterobasidion annosum*), *Tr. Pini*, *Polyporus mollis*, *P. vaporarius*, *P. Schweinitzii*, and *Agaricus melleus*.

These fungi, which are distinguished by technical characters the discussion of which must be passed over here, differ considerably in their mode of action and manner of inducing disease,* but they all agree generally in that they eventually destroy the timber of the trees, by dissolving and consuming the structural elements which compose it. Now since the timber of the Pine furnishes (1) the channels up which the water and nutritive materials have to pass from the roots to the leaves, and (2) the supporting columns by the strength of which the crown of foliage can alone be held aloft and exposed to the light and air, it follows that such destruction results in disease and death to the tree as a whole.

Trametes radiciperda, now known very thoroughly from the recent magnificent researches of Brefeld,† who also proposes to re-name it *Heterobasidion annosum* from the remarkable conidial forms which he has discovered, attacks the living roots of *P. sylvestris*, *P. Strobilus*, and others, sending its snow-white mycelium beneath the cortex, and travelling thence up the stem, to finally penetrate the wood by way of the cambium and medullary rays. The rotting of the wood rapidly follows, with symptoms so peculiar that the presence of this fungus can be concluded with certainty from them. Owing to the reddish discoloration of the timber which results, this disease has been termed the "red-rot," a name which involves confusion, however, as several other similar diseases of timber cause such discolorations.

This disease is extremely difficult to eradicate, because the mycelium travels from root to root in the soil, and the spores that the roots of certain Conifers may have hyphæ of *Gasteromyces* attached to them, though, so far as I can discover, they do not induce diseased conditions in the tree as a whole.

* For a more detailed account of these matters see "Timber and some of its Diseases," by H. Marshall Ward, M.A., F.R.S. (Macmillan & Co.)

† "Unters. aus dem Gesamtgebiete der Mykol.," H. viii., 1889, p. 154. See also R. Hartig, "Zersetzungserscheinungen des Holzes" (Berlin, 1878).

are carried by subterranean animals from one place to another; moreover, the matter has become more complex since Brefeld discovered the second form of conidial spores. Of course the fructifications should be destroyed by burning, as also the dead and dying branches, stumps, &c. Hartig has found that moats, dug so as to cut off sound trees from infected ones, have been of service.

Agaricus melleus, though a less pronounced parasite, is not less destructive; the details of its action on the timber are different, and its mode of spreading from root to root in the soil, by means of its long, purple-black, cord-like mycelial strands, called *Rhizomorpha*, also differs. But the net results are much the same in both cases. Very tangible signs of the presence of *Agaricus melleus*, in the absence of the tawny yellow "toad-stools," are afforded by the copious outflow of resin from the diseased roots and base of the stem of the affected trees, and by the above rhizomorphs in the rotting wood and soil around.

Most of the *Polypori* mentioned are decidedly wound-fungi—that is to say, they only attack successfully those parts of the timber which are already dead and exposed to the air; their influence for evil should not be underrated on that account, however, for although they are saprophytes living on the wood, their entrance into the trunk and branches means more or less rapid hollowing of the heart-wood (thereby rendering the tree liable to be thrown by winds, &c.) and the gradual production of injurious substances which soak into the sound parts and pave the way for the advance of the destroying mycelium into living organs. Hence, though such fungi are saprophytes, strictly speaking, in their local action, they nevertheless act towards the whole tree—taken as a living individual—as parasites which may induce dangerous diseases.

Remedial measures are of course to be directed to the careful tending and covering of wounds, a mode of procedure which has long been carried out on various trees at Kew, and with decided success, I believe.

A complete list of the fungi known to produce diseases in Pines would be a formidable affair in itself, and would include a large number of Ascomycetes, of which some, recently investigated, are very curious and interesting in themselves.

I have already spoken of *Hysterium Pinastri* as the cause

of leaf-casting. *Herpotrichia nigra** causes a tiresome disease on *Pinus montana*, and also on the Spruce and Junipers at high altitudes. *Hysterium brachysporum* kills the leaves of the Weymouth Pine, and Farlow and Seymour† give a long list of American forms that will necessitate much careful investigation before we can determine which are truly parasitic and which merely saprophytic.

There is in Germany a disease of the Scotch Pine known by a name which I may translate the "Pine-twist." Its prominent symptoms are contortions and curved malformations of the tips of the leading shoots, caused by the invasion of a fungus known as *Cæoma pinitorquum*. The hyphæ of this parasite so torture the epidermal region of the young shoots that their growth in length is no longer equal on all sides; considerable deformity may result from the curvatures of the healthy parts about the dead infested regions, and even the death of the tips occurs in bad seasons—i.e., seasons too wet for the Pine, but very agreeable to the fungus. In dry summers, however, the fungus-layers may die off, and the injured spots be occluded.

Robert Hartig, in 1874, showed that this *Cæoma pinitorquum* is merely the æcidial form of a fungus long known as *Melampsora Tremulæ*, and which develops its Uredo- and Teleuto-spores on the Aspen and other Poplars.

Plowright failed to confirm Hartig's results with these fungi.‡ Hartig found, moreover, that a certain disease on the leaves of the Larch is also connected with the above *Melampsora*, and this was also confirmed by Plowright. But since the latter observer has now repeated the infections, and confirmed Hartig's observation so far as the Larch is concerned,§ we are justified in hesitating before we reject the view put forward above. It is interesting (and also important) to see, moreover, that Plowright has shown that *Melampsora Betulina*, on the Birch, infects the Larch with the same disease as does *M. Tremulæ*.||

Perhaps there are two species of *Melampsora* here concerned, both of which infect the Larch; or it may be that the *Cæoma*

* R. Hartig, "Allgem. Forst. u. Jagd-Zeitung," January 1888.

† "A Provisional Host-Index of the Fungi of the United States," Part III., 1891, pp. 160-166.

‡ "Brit. Uredinæ and Ustilaginæ," 1889, p. 241.

§ "Zeitschr. für Pflanzenkrankh.," 1891, B. i., H. 3, pp. 130, 131.

|| *Loc. cit.*, p. 131.

of the Pine is different again. In any case there is an excellent and neat little problem to be solved in these alleged connections between various forms of *Melampsora* and *Cæoma*, and I recommend it to the attention of mycologists.

But of all the fungus diseases which affect Pines, none is more interesting, and few more disastrous, than the one induced by a form long known as *Peridermium*, and of which *P. Pini* is the best known. This makes its appearance on various Pines as bladder-like bags of spores protruding from the leaves or cortex, and springing from a mycelium which destroys the cell-tissues, and which may kill the upper parts of the tree by ringing its stem or branches.

As long ago as 1874, Wolff* showed that the form referred to is merely the æcidium stage of a uredinous fungus found on the leaves of certain species of *Senecio*, and known as *Coleosporium*. Further investigations partly confirmed and partly contradicted this conclusion, and led to the separation of the *Peridermium* which invades the *cortex* and *branches* of the Pines (e.g., *P. silvestris*, *P. Strobis*, *P. Laricio*, *P. montana*, &c.) from the one which infests the *leaves* of various species of *Pinus*.

Cornu† especially, in 1886, repeated Wolff's experiments, and found that the cortical form of *Peridermium* is the æcidial stage of a totally different Uredine (*Cronartium*) on certain *Asclepiadeæ*.

The whole subject of the autonomy of these fungi has been taken up quite recently by Klebahn,‡ and his investigations lead to somewhat startling results. These are too lengthy to describe in detail here, but the gist of the matter may be put as follows.

The *Peridermium* (or *Æcidium*) *Pini* of authors comprises at least three, and perhaps four, distinct species:—

(1) *P. oblongisporium* (Fuckl.) on the leaves of *Pinus sylvestris* and *P. austriaca*, the æcidial stage of *Coleosporium Senecionis* (Pers.).

(2) *P. Cornui* (Rostr. et Kleb.) on the cortex of the Scotch Pine, and which is the æcidial stage of *Cronartium Asclepiadeum* (Willd.).

* "Bot. Zeitung," 1874.

† "Comptes Rendus," 1886, pp. 930-932.

‡ "Ber. d. deutsch. bot. Gesellsch.," B. viii., 1890 (Gen.-Versamml. Heft), pp. 59-70.

(3) *P. Strobi* (Kleb.) on the cortex of *Pinus Strobus*, *P. Lambertiana*, and *P. Cembra*, and which is the æcidial form of a *Cronartium* found on species of *Ribes*.*

(4) *P. Pini* (Willd., Kleb.), on the cortex of *Pinus silvestris*, has nothing to do with *Coleosporium Senecionis*, and numerous attempts have in vain been made to settle what its Uredo-spore stage is, or on what host it grows; so that here again is a pretty puzzle awaiting solution by those who have the opportunity.

Several other forms of *Peridermium* are known on various species of *Pinus*. The following have hitherto been included with the above under the common name *P. Pini*, but no one will now be so bold as to retain them until further investigations have decided as to their relationships. The forms in question occur on the cortex of *Pinus montana* (Mill.), *P. uncinata* (Ram.), *P. maritima* (Mill.), *P. halepensis* (Mill.), *P. mitis* (Mchx.), *P. Tæda* (L.), *P. ponderosa* (Dougl.), *P. rigida* (Mill.), *P. insignis* (Dougl.), *P. Sabineana* (Dougl.), *P. contorta* (Dougl.), and some other American Pines; as well as on the leaves of the Indian *P. longifolia* (Lamb.), and of the American *P. australis* (Mchx.).

The great damage done by the cortical forms of *Peridermium* is twofold in character. In the first place the cortex and cambium are killed at the spot invaded, and this injury may go so far as to ring the stem or branch. Then, in the second place, an abnormal formation and excretion of turpentine is excited, and this soaks into the wood and renders the passage of water upwards difficult or impossible. The natural consequence is the perishing of the parts above the infested places, and in dry summers such a result is apt to follow rapidly.

Sections of Pine-stems, cut to 3-5 cm. thickness, thus permeated with turpentine, are semi-translucent; and, as has long been known to continental foresters, the abnormally resinous branches are excellent for torches, fuel, &c.

With isolated Pines, in parks and gardens, &c., it is not difficult to eradicate the disease in its early stages by judicious pruning, and burning the infested parts; far greater difficulties, of course, are met with in the treatment of forests. This disease

* Sorauer has confirmed this quite recently, finding that the spores of *P. Strobi* develop into *Cronartium Ribicola* (Dietr.) on *Ribes rubrum*, *R. nigrum*, and *R. alpinum* ("Zeitschr. für Pflanzenkr.," 1891, B. i., H. 3, p. 183).

is likely to do much damage in nurseries, and I think you will admit that a strong case is made out in favour of the need for care and further observations as regards the weeds growing in the neighbourhood of all places where Pines are cultivated from seed.

II. THE FIRS.

I take this group in the broadest sense, including in it the genera *Picea* (the Spruces), *Abies* (the Silver Firs), *Tsuga* (the Hemlock Firs), and *Pseudotsuga* (the Douglas Fir). Much that has been said of the Pines is also true of these predominantly mountain trees. I shall therefore pass at once to the description of the diseases due to fungi, merely remarking that those maladies traceable to unsuitable climate, soil, atmosphere, &c., are much as before.

Here, again, some of the most disastrous forms of disease are those due to hymenomycetous fungi which rot the timber, such as *Agaricus melleus*, *Trametes radiciperda* and *T. Pini*, *Polyporus vaporarius*, *P. borealis*, *P. fulvus*, &c., and it is scarcely necessary to add anything to what was said of these when treating of the Pines.

Again, also, it happens that, with the exception of *Phytophthora omnivora*, which destroys the seedlings of Spruces and Silver Firs, the disease-inducing fungi all belong to certain sections of the Hymenomycetes, Ascomycetes, and especially the Uredineæ.*

Undoubtedly one of the most extraordinary of all these forms is *Calyptospora Gæppertiana*, a uredinous fungus which alternates between the Silver Fir (*A. pectinata*), on the leaves of which it develops an æcidial form long known as *Æcidium columnare*, and the Red Whortleberry (*Vaccinium Vitis-idaea*), a common undershrub in the German Fir-forests, the stems and leaves of which it distorts and kills by means of the mycelium of its Uredo-form (known as *Calyptospora*—or *Melampsora*—*Gæppertiana*).

So far as I am aware, this form has not yet been met with in this country,† but it does much damage on the Continent,

* The general application of these remarks to Coniferæ as a whole may have to be modified when *Ustilago Fussii* (Niessl.) on species of *Juniperus* has been properly investigated. (See Sorauer, vol. ii., p. 209.)

† Plowright ("Brit. Ured. and Ust.," p. 271) states that he has found a similar form (*Æc. pseudo-columnare*) on various Silver Firs in England.

owing to the leaves of the Silver Fir dropping off in the second year, or even earlier, instead of persisting for several years as in the normal course of events.

Another remarkable case is that of the "Witches' brooms," very common in Europe, and by no means rare in this country. I have myself found these on *A. Pinsapo*, as well as on *A. pectinata*, in Windsor Great Park.

"Witches' brooms" are curiously tufted masses of twiggy branches, which take their origin from parts of the stem attacked by the mycelium of *Æcidium elatinum*, the Uredo-form of which is as yet unknown, and possibly does not exist. The life-history was worked out very thoroughly by the late Prof. De Bary.* The hyphæ so irritate the growing tissues of the young shoots that the latter gain enormously in diameter, and put forth numerous shoots which alter their whole character. Thus, instead of growing outwards in a nearly horizontal plane, they turn vertically upwards, and branch copiously in a fastigate manner; then their leaves are smaller, and arranged in regular spirals round the erect twigs. These leaves are infested by the mycelium, and eventually bear the *Æcidia*, and fall prematurely.

This mycelium is perennial in the cortex, cambium, and wood of the stems, and does much damage by stopping the leaders, and paving the way for rot-fungi. It happens not unfrequently in this country that the mycelium simply sojourns in the stems, and does not lead to the full development of the "Witches' broom," but only causes tumour-like swellings of the axis.

The treatment of infected trees resolves itself into careful pruning and removal of the monstrous organs. It would be well worth the time of some capable investigator to undertake further researches into the nature of this disease.

This malady, by the way, has nothing to do with the "Witches' brooms" developed on Birches, Cherries, Hornbeams, and other Dicotyledons, which are due to the ravages of various species of *Exoascus*, curious ascomycetous fungi allied to the one that causes "Bladder-plums."

Farlow has found *Æc. elatinum* on *Picea concolor* (Gordon)†

* 'Bot. Zeitung,' 1867.

† "A Provisional Host-Index of the Fungi of the United States," Part III., 1891, pp. 152-170.

and *Abies balsamea* (Mill.), and it will probably turn out to be more widely spread than has been hitherto suspected.

The Silver Firs suffer from a number of other Uredineæ, of which *Cæoma Abietis pectinata* is a form reminding us, by its habit and behaviour, of *Calyptospora Gæppertiana*.

The Spruces (*Picea*) are also apt to suffer much from Uredineæ, of which the genus *Chrysomyxa* is one of the most important. Several species of this fungus do considerable damage to the leaves, by causing them to fall prematurely—e.g., *C. Abietis*,* *C. Rhododendri* and *C. Ledi*—the former being autæcious, and only occurring in the Teleuto-spore stage, so far as is known; the two latter being heteræcious, the *Æcidia* developing on the leaves of the Spruce, and the Uredo-forms on the leaves of *Rhododendron ferrugineum* and *R. hirsutum*, and on those of *Ledum palustre*. Farlow says that *C. Abietis* occurs on *Tsuga canadensis* (Carr.), which suggests the probability that this form again is more widely spread than has been supposed hitherto. Münter states that *Picea alba* (Lk.) is not affected by this disease. I quote from Sorauer,† and cannot speak from my own knowledge; but Farlow does not give this fungus on *P. alba*.

Spruces (and to a less extent Silver Firs and Pines) are often affected with a disease caused by an Ascomycete (*Nectria Cucurbitula*), the hyphæ of which find their way through small wounds in the cortex, into the sieve-tubes, &c., of the phloem, and set up a struggle for existence, which is very interesting to the biologist, though it may be viewed with different feelings by the horticulturist. It appears that so long as the Fir is doing well, the parasite is confined to the resting parts of the phloem, and cannot make its way into the active cambial region, the living cells of which go on dividing and growing quite normally; if the attacked branch is particularly vigorous, the formation of a layer of cork may be accomplished, which cuts off all the diseased tissues, which then dry up and are thrown off.

It is a particularly instructive fact, however, that if the season is one unfavourable to the rapid and vigorous development of the cambium, or the tree generally, or if conditions exist in the soil or atmosphere which retard the vegetative activity of the cells,

* Beautiful figures of this are to be found in Willkomm, "Die mikroskopischen Feinde des Waldes," 1867, Taf. IX. The text is now chiefly of historical interest.

† "Pflanzenkrankheiten," 2nd edit. 1886, vol. ii., p. 248

the mycelium of the *Nectria* is enabled to conquer the tissues of the cortex, and even to kill the cambium and penetrate into the young wood.

If this happens all the parts above the attacked place are apt to dry up and die, evidently from the stoppage of the water currents up the stem; this very often occurs with thin watery twigs—so-called “unripened wood”—such as may be found in shaded situations, or in very damp summers.

From the dead cortex come the white conidial cushions, about as large as pin-heads, followed by the scarlet stromata with immersed ascogenous fructifications.

There are many other very interesting points about this disease; and as it is a type of an exceedingly important series of diseases, very little understood in England, I shall venture to direct your attention for a few minutes to some of the results.

While relying for the most part on the researches of Hartig,* so far as this particular species is concerned, I ought to say that the following conclusions are based on some experience of my own.

These *Nectrias*, though very common indeed, are usually found as decidedly saprophytic fungi, living in the dead wood and cortex of fallen branches, or the parts of trees killed by entirely different agencies—*e.g.*, frost, breakage, insect injuries, &c.—and experiments show that the germinal tubes developed from the spores are unable to penetrate the sound tissues of living branches. On the other hand, it is quite easy to infect a tree if one punctures the sound cortex with the point of a scalpel on which a few spores have been rubbed. The puncture kills a number of cells, and the hyphæ feed on the solution of food-materials thus formed; and it is only from a position of advantage like this that the mycelium, waxing in vigour day by day, is able to invade the tissues around, and gradually kill and destroy those that are not active enough to resist it. As already said, the mycelium may fail to do more than establish itself in the more worn-out portions of the inner cortex, and may then be cut out and cast off by layers of cork. There is considerable reason for believing that it makes all the difference to the fungus what kind of start it gets; if the mycelium is still young and feeble, the active tissues of the cortex may cut it out very soon,

* “Unters. aus dem forst-bot. Inst. zu München,” I., p. 88.

and the ordinary observer can find no trace of the invading fungus, or of disease, but if it starts in a bed of dead and dying cells capable of yielding it sufficient food-materials (the hyphæ can grow in a matrix flooded with turpentine) its rate of spread depends almost entirely on what resistance is offered by the vegetative activity of the cells around. Hartig found that the germinal hyphæ of *N. Cucurbitula* find entrance into Spruce Firs through the wounds caused by certain insects (especially *Grapholitha pactolana*), and also through such as are caused by the heavy blows of hailstones, which bruise and tear the tissues of young shoots. In the case of other *Nectrias*, which cause wounds on non-coniferous trees, I have convinced myself that ruptures caused by frost, mechanical injuries (*e.g.*, such as are produced by climbing trees to pluck fruit, &c.), pruning, &c., afford the opportunities of entrance to the fungi.

There is a deeper problem beneath all this, however, and that refers to the exact nature of the mutual actions and reactions between the hyphæ and the living cells of the host; all I can say here is that it is pretty clear that the hyphæ excrete some poison-like substance which the living cells of the cortex and cambium either break up and destroy, or merely resist the action of, so long as they are strong, well-fed, and vigorous. Once let such cells fall below a certain standard of health and activity, however, and the hyphæ make their way in and demolish all before them. Obviously the factors of the inorganic environments—soil, temperature, light, atmosphere, and so on—may determine the balance of events in this connection.

In conclusion, I may add that *Nectria Cucurbitula* is not uncommon in this country, where it is usually found on dead branches, and Farlow reports the occurrence of this species on *Pinus Strobus* in the United States, and of several other species on other North American Coniferæ.

The Douglas Fir (*Pseudotsuga Douglasii*) has, so far, shown but few fungus diseases in this country and on the Continent, but since *Agaricus melleus* and *Trametes radiciperda* are among its enemies, it is not improbable that it may be found to suffer from maladies not found on it in (or at least not reported from) its native country. Farlow adds *Trametes Pini* to the list of its hymenomycetous enemies.

So recently as 1888,* Von Tubeuf has discovered a disease on this Fir which may prove very troublesome in wet districts. The tips of the branches droop, and their leaves fall off, but remain hanging by means of a greyish mycelium, which holds them together as if attached to the tips by means of spiders' web.

This mycelium gives rise to sporophores and sclerotia, which prove it to be a *Botrytis* (*B. Douglasii*, n. sp.), and if it turns out to be as destructive as some of its congeners (*e.g.*, the *Botrytis* of the Lily-disease†), foresters will certainly have to reckon very seriously with it.

The damage is done by the mycelium penetrating between the cells of the leaves and young shoots, and killing the tissues forthwith. One source of danger is that this fungus can live as a saprophyte in the dead foliage, &c., on the ground, as well as parasitically in the living shoots; and that it develops very efficient resting organs, known as sclerotia, which enable it to tide over unfavourable seasons.

It appears that this *Botrytis* has also been observed on the Larch, and on Silver and Spruce Firs.

It is as yet too soon to attempt to decide as to the extent of the danger with which the fungus threatens us; we know very little, moreover, as yet, as to the capabilities of the Douglas Fir itself in this country. Perhaps the greatest damage so far done to it is by winds, but for my own part I feel that this Conifer is still too new to the British Islands‡ to be finally reported upon, and it is not surprising that we know as yet very little about its diseases.

It is with the Firs as with the Pines, as regards the large numbers of diseases due to fungi: the American list is very long, and our own is by no means either short or exhausted.

The Hemlock Fir, Silver Fir and Spruce suffer in Germany from a leaf-fungus (*Trichosphæria parasitica*) which reminds one in many respects of some of our *Erysipheæ*. The seedlings of these and other Firs are destroyed by *Phytophthora omnivora* and by a *Pestalozzia* lately re-examined by Von Tubeuf. Almost as I write§ comes the announcement of another

* "Beitr. zur Kenntniss d. Baum-Krankh." (Berlin, 1888).

† See "Annals of Botany," vol. ii., 1888, "A Lily Disease."

‡ I am told that it was only introduced in 1826.

§ Zeitschr. f. Pflanzenkrankh., B.i., H. 3, 1891, p. 179; see also B.i., H. 1, 1891, p. 47.

disease of the Spruce, said to be found "all over Germany," and due to the hitherto unsuspected parasitism of a *Septoria*, and so the work goes on.

III. THE LARCHES.

The European Larch is apt to suffer very much from combinations of circumstances in the environment, when planted in this country; and when one compares the conditions under which it is attempted to grow it with those prevailing in the natural home of this tree, the wonder is, surely, not that our Larches suffer, but rather that any of them escape.

The European Larch is a native of the Alps, and of the higher mountains of Northern Europe, growing naturally at altitudes which ensure a pure atmosphere, brilliant sunlight, plenty of distributed moisture, and rapid drainage; in its mountain home it has a relatively long and thorough winter rest, from which, like Alpine plants generally, it rapidly awakens late in spring, and then makes vigorous growth through the brilliant and comparatively hot summer.

In this country the diseases of the Larch are almost all initiated by late frosts, damp soil, insufficient sunlight, and alternations of periods of drought with periods of excessive moisture, in various degrees of combination.

Late frosts, or chills which approach such, are among the most deadly agents. The tender tufts of bright green foliage, to which the Larches owe their spring beauty, are usually forced out in this country from a month or six weeks too soon—as compared with what occurs in the Alps, &c.—and the succulent shoots and leaves are thus apt to suffer from the sudden oncoming of cold winds or frosts as they slowly drag along their precarious development. Once they get well over this early dilatory period of sprouting, all is safe; their safety is ensured in their mountain heights by (1) their not beginning to awake from the long winter rest till danger of frosts is practically over, and (2) by the extreme rapidity with which they run through the period of tenderness.

Our damp climate, moreover, is calculated to bring it about that the roots of Larches, as of other Conifers, run risks not likely to be incurred in the rapidly drained soils of their Alpine homes. But the conditions referred to thus briefly are just those

which favour certain enemies of the Larch at the very time that they are acting prejudicially to that tree itself.

I have great confidence, therefore, in the well-thought-out view, first put forward, I believe, by one of the most distinguished and able of modern investigators—Professor Robert Hartig, of Munich—that the appalling liability of the Larch to disease at low altitudes, and in climates which are too moist and variable during the spring and early summer, is due to the co-operation between the factors of the inorganic environment and the directly injurious action of its living enemies.

The Larch suffers severely from several fungus diseases—*Agaricus melleus*, *Trametes Pini*, *Polyporus sulphureus*, and others being among them; but all other forms have sunk into insignificance beneath the overwhelming importance of the “Larch-disease,” or “Larch-canker,” due to the parasitism of a minute discomycetous fungus known variously as *Peziza Wilkommii*, *Lachnella calycina*, *Dasyyscypha calycina*, &c.*

The main facts † which are of importance to you are, that this *Peziza* develops from its spores a mycelium which, when once it has established a hold in the inner cortex of a branch of the Larch, can go on growing and extending into the cambium; this it kills, destroying a larger area year by year, and producing the so-called “canker” patch, which is simply a shrivelled mass of dead tissues impregnated with exuded turpentine or resin. If the dead patch extends all round the branch or stem, all the parts above may die off, partly because, the cambium being destroyed, there is no more wood developed at that region to carry up the water supplies to the leaves, and partly because the resin blocks up the wood which it permeates.

To understand how it is that the Larch-fungus spreads so rapidly and with such dire effect in Great Britain, it is necessary to note some peculiarities not always properly appreciated.

Peziza Wilkommii, like other fungi, requires merely water, oxygen, and a suitable (not very high) temperature for the germination of its spores; given these, the germinal hyphæ are developed anywhere. The mere germination of a spore may, therefore, take place on any damp surface exposed to the air—

* For the synonyms consult Phillips, “Brit. Discomycetes,” p. 241, and Saccardo.

† An illustrated detailed account of this and similar diseases is given in “Timber and some of its Diseases” (Macmillan & Co.).

e.g., the soil, the bark of old trees, or the thin cortex and leaves of the twigs and young trees, &c.

But millions of spores may go through this process of *germination*, and then the germinal hyphæ die off for want of further food-supplies; whereas if any one of these hyphæ finds its way into the succulent cortex of a Larch, it is nourished at the expense of the tissues, spreads into the cambium, and brings about the disease referred to as the "canker of the Larch."

As matter of experiment—and only by experiment can we arrive at such knowledge—it is found that if spores of this fungus germinate on the sound bark, cortex, leaf, or other part of the Larch-tree, the germinal hyphæ fail to effect an entrance; if, on the other hand, the spores are sown on a wound, however slight, in the cortex of the tree, it is able to enter and infect the latter.

Now the thin cortical covering of a young Larch stem or branch is a dangerously tender envelope to the tissues below, and it is rapidly protected later on by a rather thick coating of cork. As matter of fact the corky "periderm" begins to form, just below the epidermis, before the end of the first year, and is increased every year afterwards. When the tree is about twenty years old the real bark begins to be formed, owing to the development of internal layers of cork.

Obviously the period most dangerous to the Larch is that during which its cortex is still tender and its leaves succulent and delicate. In its Alpine home this period is rapidly passed through; in the lowlands of Europe, and in damp insular climates, this period is apt to be a dilatory one, and severe checks from frosts, cold winds, periods of dull, misty, "sunless" days, &c., are apt to cause the trees to suffer in all kinds of ways. But such periods are not calculated to check the spread of fungus-spores to any comparable extent; and so we may regard these conditions as disavouring the Larch, but not its enemy.

Moreover, such conditions indirectly *favour* the fungus, for the tender shoots and young leaves of the Larch are apt to be cut by frosts, bruised and torn by winds, broken by snow, and injured in various ways by the inclemency of weather which would not injure them before the buds opened, or after the twigs

and leaves were hardened and in full working order. In fact, if we could persuade our Larches to remain dormant for a month later in the spring, they would escape the evils of which they now run the gauntlet, as it were.

It is during this period of dalliance in the opening of the buds and pushing of the young shoots that all kinds of small wounds are made by frost-cracks, bruises from hail and wind, breakages from the snow and storms, and, I believe, insect-injuries, and it is into these small wounds that the hyphæ of the *Peziza* penetrate.

This view is fully borne out by the observations in the open that the young "cankers" commonly start around the base of a dead shoot; that trees growing in damp situations are particularly apt to suffer; the prevalence of the disease in neighbourhoods and seasons where and when certain insect-enemies of the Larch abound (e.g., the moth *Coleophora laricella*, and the aphid *Chermes Laricis*).

I have entered into some of the above details regarding the above case of a struggle for existence, partly on account of its intrinsic interest and importance, and partly because a recent writer,* in an article on the "Canker of the Larch," which I cordially welcome as a very neatly written outline of some of the leading features of the subject, and as giving evidence of interest in these matters as yet too rare in this country, has misunderstood some of the points at issue, no doubt owing to loose usage of the word "bark." There is no true bark on a young Larch stem or branch, but only cortex protected by periderm. However, allowing the misuse of the word "bark," the statement that "This fungus has the same power as the Potato-fungus of penetrating the protective covering of the plant, but in this case it can penetrate only the young bark," is one of those allegations that have no value whatever to a scientific man unless supported by proof. Nor is it correct to say that "the fungus does not penetrate the wood, so that when the bark is removed the seat of the disease is got rid of." I wish such were the case; but the fungus, unfortunately, may find its way right into the wood and through the medullary rays even to the pith.

In the case of park trees, and such specimens as horticulturists

* J. B. Carruthers, "Journal of the Royal Agricultural Society of England," vol. ii., ser. 3, part 2, 1891.

are dealing with, much may be done by careful pruning and paring, combined with drainage and protection; but unquestionably this Larch-disease is a difficult matter to struggle with when once it has made headway. The best "cure" is, of course, prevention—i.e., plant sound trees, learn to recognise the earliest stages of the disease, and if it appears cut out the young patches and burn every trace of diseased cortex.

Very few Larches are cultivated, and I do not know whether the Himalayan *L. Griffithii* suffers from the disease just dealt with. Farlow mentions *Trametes Pini* as occurring on *L. americana*.

A subterranean fungus known as *Rhizina undulata* has lately been found to be very destructive to young Larches, Silver Firs, and other Conifers (e.g., *Tsuga Mertensiana*, *Pseudotsuga Douglasii*, *Picea sitkensis*, and *Pinus Strobus*). It seems to belong or be related to an obscure group of fungi known as *Rhizoctonia*, which still need careful investigation.*

It will probably be observed that I have followed no very strict classification of the Conifers in this address, but have simply chosen groups convenient for the purpose in hand. I propose to take the remainder of the Conifers in equally arbitrary groups, and first of all certain of the Cupressinæ.

IV. THE JUNIPERS.

The most remarkable diseases of the Junipers are those due to various species of a uredinous fungus known as *Gymnosporangium*, the hyphæ of which so irritate the cambial region of the stems of these Conifers (in which the mycelium is perennial) that peculiar woody swellings are produced, sometimes in such quantities as to distort, and even kill, the stems. From these swollen parts of the branches the Teleuto-spores are produced in enormous quantities during the spring, and some most remarkable facts have been elucidated by the researches of recent years—facts which show that there is still much to be done before we have exhausted the biology of these disease-inducing fungi.

It has long been known that these *Gymnosporangia*, confined to the various species of Juniperus, are merely the Teleuto-spore condition of forms which when growing on certain species of

* "Sitzungsber. d. Bot. Ver. in München," Jan. 12, 1891.

Rosaceæ—*e.g.*, Pear, Hawthorn, Mountain Ash, Service-tree, &c.—present a totally different appearance; these æcidial forms on the Rosaceæ received the name of *Ræstelia*.

Various "species" have been described of both. Besides this, Farlow has investigated a number of American forms, found on Cupressineæ and Rosaceæ in the United States.*

A number of careful experiments have been made in this country by Mr. Plowright, one of the best authorities in England on the Uredineæ, and he came to the conclusion that about four species of *Gymnosporangium* may be upheld as far as this country is concerned. These species occur on *J. Sabina* and the Pear; *J. Sabina* and the Hawthorn and others; *J. communis* and Hawthorn, &c.; and *J. communis* and the Mountain Ash.

But Mr. Plowright's cultures, like those of others, suggested that much difficulty is incurred in attempting to keep the forms distinct; and with the caution of a true scientific man, Mr. Plowright, in one case at least,† suspected he had perhaps used mixed Teleuto-spores, instead of concluding on insufficient evidence that the Teleuto-spores of *Gymnosporangium Sabinae* infect both the Pear and the Hawthorn; perhaps it was less commendable on Mr. Plowright's part to form a new species (*G. confusum*), though at the same time it is difficult to see how he should avoid it without much further research, and only those who have had much experience know how troublesome such investigations are.

The results of such infection-experiments from various sides were to arouse suspicions as to the autonomy of some of the species, though some of the main points were confirmed by all. Credit is due to Mr. Plowright for establishing the converse culture of the Æcidio-spores on the Juniper, in the case of *G. clavariiforme*.

Some recent experiments by Tubeuf‡ seem to have raised the whole question of the species of *Gymnosporangia* again, and I mention this here because it seems to me of importance that the question should be settled, as it affects the cultivation of

* "The Gymnosporangia, or Cedar-Apples of the United States," Ann. Mem. Boston Society of Natural History, 1880.

† "Brit. Uredineæ and Ustilagineæ," p. 233.

‡ "Centralbl. f. Bakteriologie u. Parasitenkunde," B. ix., 1891, p. 89.

Pears, Apples, Hawthorns, and other Rosaceæ, as well as Junipers and other Conifers.

Tubeuf says that one and the same *Gymnosporangium* can produce various forms (so-called species) of *Ræstelia*; and that different species of this Uredine may be made to infect the same host-plant.

If *G. clavariiforme* is sown on *Cratægus*, it produces *Ræstelia cornuta*. On the Mountain Ash and on *Cydonia vulgaris* it only goes so far as to produce spermogonia. On other hosts it grows and infects the leaves, but does not get beyond the production of yellow humps.

When the same *Gymnosporangium* was sown on various species of *Cratægus*, Tubeuf says he got both *Ræstelia lacerata* and *R. cornuta*, though these two forms have usually been supposed to belong to separate species. No results were obtained on Apple, *Sorbus aria*, Medlar, &c.

Whether further researches show that these results are confirmed or not, it is certain that we have in these forms of *Gymnosporangium* and *Ræstelia* parasitic fungi which are highly polymorphic,* and heterœcious between Cupressinæ and Rosaceæ (as many other "Rust-fungi" are between Gramineæ and dicotyledonous plants), causing diseases of the cortex and wood of the one, and of the leaves in the other. Obviously it is advisable to take these facts into account where it is wished to grow either of these classes of plants in the best way.

V. OTHER CONIFERS.—CONCLUSION.

Agaricus melleus is recorded by Farlow as occurring on *Chamæcyparis sphaeroidea* (Spach.), and the same authority mentions *Botrytis vulgaris* on Sequoia; whether these are parasitic, I do not know, and in fact the whole of the very long list of American Conifer-fungi wants careful overhauling before we can decide as to their share in producing diseases.

I have found the roots of Wellingtonia badly infested with mycelium which seems to be that of a Hymenomycete; and Araucarias occasionally suffer from similar forms.

The Yew seems to be very little affected with fungi; at least

* I purposely omit discussion here of such points as Kienitz-Gerloff's discovery of alleged Uredo-spores among the Teleuto-spores of these fungi.

I can recall no satisfactory case of fungus disease in this Conifer.

Little or nothing seems to be known of the diseases of *Cryptomeria*, *Taxodium*, *Cephalotaxus*, *Ginkgo* (*Salisburia*), or *Podocarpus* and other allies; and I know of no records of specific diseases of the Cedars. Two species of *Cladosporium* are said to injure Pines, and Hoffmann* attributes the "Witches' brooms" of the Scotch Pine to these *Pyrenomycetes*. Several *Æcidia* are known to grow on the scales of various cones (e.g., *Æ. Strobilinum*, *Æ. conorum*), and there is a curious form in Finland and Sweden (*Æ. coruscans*) which so alters the aspect of young Spruce-shoots that they resemble cones.†

Several Conifers, especially the Pines, are known to have subterranean fungi at their roots, but apart from any symptoms of disease. The fungus causes the attacked root to swell and alter its form, and the symbiotic compound body is called a *Mycorrhiza*. These curious phenomena lie outside of my present theme, however, as also do the no less remarkable abnormal-looking outgrowths—so-called "knees"—from the roots of *Taxodium distichum*, and the tubercles caused by fungi on the roots of *Podocarpus*.

More to the point at present are the cases of "sooty-leaves" of *Araucaria excelsa* and the Yews, due to the black mycelium of species of *Capnodium*, and those of the Silver Fir, due to *Apiosporium*. *Septoria Pini* (Fuckl.) on the leaves of *Picea excelsa* may be the spermogonia of the *Hysterium nervisequum* found on that plant. An observation of Farlow's in 1884,‡ that certain *Æcidia* on the Firs of the White Mountains only occur on the dwarfed trees at great elevations, seems deserving of further examination.

A. Cucurbitaria (*C. pithyophila*, Fr.), reported as occurring on the cortex of living and dead branches of Coniferae, also requires investigation. The same remark applies to Cooke's *Asterina cupressina* on leaves of *Cupressus*, and to Saccardo's *Meliola Abietis* on *Abies*, Ellis's *Coryneum juniperinum* on leaves of American Junipers, Cooke's *Dothidea halepensis* on Pines and *D. sphaeroidea* on Junipers, and the *Pleospora laricina* of Rehm;

* "Allgem. Forst- und Jagd-Zeitung," 1871, p. 236.

† Not to be confounded with the cone-like deformations on the same plant due to insects—*Chermes viridis*.

‡ "Appalachia," vol. iii., part 3, Jan. 1884, quoted by Sorauer, p. 249.

also a large number of as yet very obscure forms, such as *Sphaerella*, *Stigmatea*, &c., &c.

With regard to a large number of these forms, and to even more numerous foreign forms, we are as yet quite in the dark as to whether they are parasites or not.

Experience warns us, however, that in many cases epidemic fungus-diseases suddenly force themselves on our attention owing to some form, hitherto occurring sparsely and known only to the curious expert, having become suddenly favoured in its struggle for existence. I have already given you several examples, notably that of the Larch-disease, into the life-struggles of which we have succeeded in peering rather deeply. Surely such considerations should alone suffice to extend and cement that sympathy between the practical horticulturist and the persistent, though perhaps unobtrusive, investigator which, I am happy to see, is becoming more and more pronounced as each understands better the ways and high aims of the other.

It should be borne in mind, finally, that plant-diseases, like human diseases, cannot be fully elucidated by a layman—though it is astonishing how frequently the contrary assumption is acted upon in the case of both. There seems to be a fatal temptation in the idea of disease to the minds of most men, and the response is dogmatism.

INSECTS INJURIOUS TO CONIFERÆ.

By Mr. W. F. H. BLANDFORD, M.A., F.R.H.S., F.Z.S.

OF all families of trees the Coniferæ suffer most severely from the attacks of insects, owing to the large number of species which they support, and to the difficulty which, on account of their physiological characteristics, they have in withstanding injury.

The wide area over which forests of these trees extend increases the danger of insect-attacks, in accordance with a well-known law which holds with injurious insects, and it is

among Coniferæ alone among trees, and among the forest-species of Pine, Fir, and Larch—for the Yews, Cypressess, Thuyas, &c., do not now concern us—that have happened those repeated instances of widespread destruction over large forest areas which, occurring even before economic forestry began to change the character of the primitive mixed woods, probably increased in number and severity at that epoch, and have continued at intervals to the present day.

A striking example of this destruction is that which happened in the period 1853-68 in East Prussia, Poland, and Russia, when the Spruce was killed over an area of 7,000 square German miles. A similar instance is that afforded last year in the Bavarian forests by the plague of the same destructive insect (*Liparis monacha*); the loss caused by this to the revenue was estimated at £40,000.

The immense importance of these attacks has given an impetus to the study of forest-insects on the Continent, and a not inconsiderable mass of literature has sprung up. In this the foremost place must be given to the works of Ratzeburg, who was the first to place this branch of entomology on a truly scientific basis. His books, from the monumental "Forst-Insekten" (1839) to the equally remarkable sequel "Die Waldverderbniss" (1868), are a testimony to his unwearied industry and success in the collection of facts and the study of obscure life-histories, and of his capacity for marshalling these so as to deduce important general principles; while the idea of the "struggle for existence" running through them demands that everyone who seriously studies this later conception shall be acquainted with their contents.

Of the two books referred to, "Die Forst-Insekten" is concerned with the life-histories and habits of injurious insects. In some respects this work is out of date, as is the case with all entomological works of that period; but the numerous details given, the original descriptions of species and the excellence of the illustrations, at least in an original copy and not in a badly coloured reprint, make it a classic. "Die Waldverderbniss" deals with the effect on the trees of insect-attacks, and is especially valuable for the plates, which form a unique atlas of vegetable pathology illustrating the altered appearance both of stems, branches, &c., damaged by insects or mammals, and that of

the whole wood when the majority of its trees have suffered. This book is not as well known as it should be—a circumstance due, perhaps, to its being too entomological for most botanists, too botanical for most entomologists. The text and plates are arranged according to the species of trees, beginning with the most important, and it is interesting to note that the whole of the first volume (274 pp.) is occupied by the Pine and Spruce-Fir; the first eighty pages of the second volume are taken up by the Silver Fir and Larch, while the twelve genera of deciduous trees occupy 264 pages. Forty-three plates illustrate these four Conifers, and ten the deciduous trees, a fact sufficient to show the immense importance of the subject of this paper.

Besides Ratzeburg and his pupils and successors, Perris in France, Lindeman in Russia, and Packard in the United States have especially contributed to our knowledge of Conifer-feeding insects.

In Great Britain less has been done to advance our knowledge of them, perhaps because owing to geographical position and climate its insect population is comparatively small, and serious damage is fortunately rare. The three worst enemies to Conifers in Europe are the moths *Gastropacha Pini* and *Liparis monacha*, and the beetle *Tomicus typographus*. Now *G. Pini* does not occur in Great Britain; *L. monacha*, though not rare in the Oak-woods of the South of England, is unknown as a Conifer-feeder, and is never destructive; and *Tomicus typographus* is very scarce and most likely to be found as a "casual" in the bark of imported scaffold-poles, &c. There are, of course, many papers scattered through British journals of entomology and sylviculture on those six or seven species of insects which have done serious injury to Conifers, but there is a deficiency of information with regard to the less important kinds.

In the large number of insects feeding on these trees only a few are of habitual importance, but exceptional abundance of a normally unimportant species will bring about unexpected damage. This sometimes occurs in Great Britain, and I have heard complaints of damage which was not assignable to any of the regular destroyers, but which could not be identified in the absence of specimens. It is about these casually destructive species that we require to know more.

Now the standpoint of the systematic entomologist, or of the

collector, is not the same as that of the economist, and papers written by the one will not always serve for the enlightenment of the other. The former is apt to neglect certain small points bearing on the habits of the insect which do not immediately concern him, and especially those connected with the appearance, vitality, and aftergrowth of the plant on which his prey lives; while the economist, more particularly the practical forester, who thinks more of the injured plants than of the destroyer, has occasionally a royal disregard of the sordid details of specific characters, which brings him into trouble when he discovers that closely allied species often have remarkably different life-histories. In writing the account of any new injurious insect it is essential that an *exact* determination of the species shall be made, and the life-history constructed as completely as possible from personal observation, especially with regard to times of appearance, or if already recorded it should be verified by observed facts.

It would not be difficult to compile a complete list of British Conifer-feeding insects by collating such lists covering the whole of Europe with our systematic catalogues, and by searching scientific papers, and their biographies might be written by supplementing the deficiency of British observations with the work of continental authorities. But such an account would not be satisfactory. The times of emergence and number of broods of a species, the habits and food-plant, often differ in different countries. The process of leaning upon the observations of others can be carried too far, and not a few pitfalls await him who tries to write the life-history and economy of a British insect from materials collected in foreign countries. That of *Liparis monacha*, for example, would be singularly wide of the mark.

I propose in this paper not to surmount the difficulties which stand in the way of giving an exhaustive account of our Conifer-feeding insects, but to touch briefly on the few important and well-known kinds, and especially on those points in the habits of each which are directly concerned with practical treatment. Unable as I have been to examine, in the intervals left by other work, the mass of scattered information on the subject of attacks in Great Britain, I cannot claim any special authority for, or novelty of information in a paper put together with the assistance of such literature as has been accessible. But the ignorance of

insect-attacks, displayed even by responsible people, is often so astounding that one has a right to expect that even the simplest and best-known facts will have the charm of novelty for somebody.

The special liability of some Coniferæ (Pinus, Picea, Abies, Larix) to injury by insects, and the important character of such injury, are due to the following facts :—

1. There is a very large number of insects which attack them. Kaltenbach enumerates 299 on the forest Conifers in Europe. This number falls, indeed, far short of the 537 assigned to the Oak, but neither list can be taken as strictly accurate. Many species are omitted, especially from the former list, while in the case of the Oak the number appears to be swelled by the dragging in of species having little real connection with that tree.*

In Ratzeburg's "Forst-Insekten" 95 species are tabulated as injuring Coniferæ, while only 36 are referred to the Oak ; but subsequent researches would increase both these figures.

2. Every part of the tree is liable to energetic attacks from one insect or another—the roots, the bark of the trunk and branches, the wood, needles, shoots, and lastly the cones, the seed-production of which may be greatly lessened by insects feeding in their interior.

3. A common form of injury, especially on the Continent, is defoliation. Now complete defoliation of a Conifer, other than the Larch, usually means the death of the tree, because of the slowness with which the injury is repaired.

If an Oak is stripped by *Tortrix viridana*—an annual occurrence in many English woods—or a Hawthorn by *Hyponomeuta padella*, as in our London parks and gardens, the tree generally grows a new crop of leaves late in the year, provided that the defoliation is sufficiently complete and sufficiently early ; but if a Spruce or Pine be stripped and survive, not only are no further needles produced the same year, but next year's growth may be delayed a month, and the new needles are stunted and form the curious "bristle-needles" figured by Ratzeburg. The tree will take four or five years to recover its normal covering of needles, and with them its normal process of growth ; so that during that period the total incre-

* The list gives all insects occurring on the tree, whether injurious or not.

ment will only equal, or may even be less than, that of a single ordinary season.

4. Defoliation renders a tree liable to the attacks of other insects, especially of the much-dreaded bark-beetles, which have so often completed the havoc begun in European forests by hordes of caterpillars. I do not intend to discuss here all the various aspects of the perennial and much-vexed question as to the economic importance of these and other wood-feeding insects, and the susceptibility of perfectly healthy trees to their attacks, but reference to it cannot be entirely omitted.

It may be true that bark-beetles and longicorns never attack a tree in perfect health; that is the opinion of many entomologists, whose number by no means includes all those whose familiarity with forestry compels them to keep sight of the practical side of the question—men like Eichhoff, the leading authority on these beetles and the head of a large forest-district, Judeich and Nitsche, &c. Yet a disease would not be considered unimportant by the physician because it rarely or never attacked the robust; if it occurred as the sequela of other complaints, killing patients whose recovery would have been certain, it would demand serious attention. So these beetles, as the health of every tree in a forest cannot be assured, still possess importance even if their attacks are limited to the sickly plant.

But though no one doubts that they, in common with all insects, prefer an unhealthy plant to a healthy one, they may not always reject the latter. Here in Great Britain there is great difficulty in arriving at a just conclusion, for many injurious species are unknown or are exceedingly rare, and it is dangerous to argue about the habits of any one kind from analogy with those of another. Though a species breeding in small numbers in a wood with plenty of brood-material may let alone timber which it would attack if it were present from any cause in immense swarms impelled by the necessity of egg-laying and with lack of suitable breeding-places, there is yet evidence that these insects, if dying or injured wood is not at hand, attack sound trees for egg-laying, and if the assault does not succeed, the large number of attempted burrows serve to weaken the tree, which may succumb after several repetitions. When it is recollected that a square mètre of bark has been known to contain nearly five thousand larvæ of *Tomicus typographus*, it will be seen that a

large quantity of suitable breeding-material may cause an increase in the numbers of these insects that will jeopardise the healthy trees. A particular form of injury inflicted by some of these beetles is that of attacking and breeding in the crown and upper branches of old trees whose vitality is not great. This attack, which spreads down the branches till the main trunk is involved, has been described on certain deciduous trees, and is of importance as likely to be overlooked.

Damage by storm, snowfall, frost, or by forest fires, or caterpillar-defoliation, together with careless forestry and the slovenly accumulation of loppings, felled timber, and unbarked logs, serve to foster the development of such insects till serious injury is risked. The thin-barked Spruce suffers more than the Pine, and it was the forests of this tree that were so terribly ravaged by bark-beetles in the Harz Mountains during the last century.

Except the Pine-beetle (*Myelophilus piniperda*), no bark-beetles cause extensive damage in Great Britain; still many injurious kinds do occur which might cause trouble if the circumstances which favour them be disregarded through overconfidence in their supposed innocuousness. Every forest-tree cannot possibly be in a perpetual state of robust health, and there is one period when every tree is liable to insect-attacks—after transplantation.

That bark-beetles have been associated with the destruction of trees over immense areas is undoubted; and it lies with the advocates of the theory that their presence is immaterial to show what those forests would have died from in the absence of bark-beetles, instead of invoking mysterious and unnamed "diseases." The most serious attempt to prove another cause for the destruction of the trees is that of Lindeman, who associated the beetles with the presence of *Agaricus melleus*. This, however, appears to be definitely disproved.

5. Not a few insects feed during some part of their lives on or in the young shoots of Conifers, in the leader or the extremities of the lateral branches. When the leader perishes the upward growth is checked until one or more branches of the top whorl twist round to supply its place. So lateral branches are destroyed or have their growth stopped, and the tree becomes altered in shape and appearance. Such mutilated Pines abound in almost all woods in the South of England.

6. The practice of growing large pure woods of Conifers of uniform age tends especially to widespread ravages. Most Conifer-feeding insects will not touch deciduous trees, and many are confined to a single species of Conifer. Others, again, limit their attacks almost completely to a single period in the life of a tree. *Curculio Abietis* is very destructive to trees under seven years old, comparatively harmless to those of ten or more years. In a pure wood the conditions favourable to increase of an insect pest exist over the whole area at once, and there is no limit to the supply of food, the facilities for egg-laying or for migration to fresh districts from the part infected.

Under the circumstances, a bad insect-attack localised in one spot of an extensive forest is an exceedingly dangerous thing, and it has been necessary on several occasions to isolate such an area in a European forest and destroy it with fire to prevent the hatching of myriads of winged moths which would spread over the neighbourhood. The danger and expense of so drastic a measure are obvious. It is a universal rule that the larger the district cultivated with any particular plant the greater is the risk of insect-attack, while small isolated plantations become infested with difficulty. A good instance is afforded by the annually recurring depredations in the Eastern Counties of the Mustard-beetle (*Phædon betulæ*), unrecorded as a destroyer before 1854; with the continual growing of Mustard there the insect flourishes, and will continue to do so till farmers agree to rotate their crops, so that no Mustard shall be cultivated for a year over large areas.

Similarly the Raspberry-shoot borer (*Lampronia rubiella*) appears to be increasing in the South-east of England, owing to the enormous Raspberry-plantations which occur there. It is not readily amenable to treatment, and is beginning to cause annoyance to many growers.

It will be convenient to take those insects now under consideration in an order agreeing partly with the period in the life of a tree when they are most mischievous, partly with the character of the injuries they inflict, rather than in one determined by their zoological position.

Seedling Conifers, if the nursery be placed in a well-chosen situation, secure from the inroads of *Curculio Abietis*, are usually

exempt from the attacks of special Conifer-feeding insects, Their chief enemies are the polyphagous wireworms, the larvæ of the "click-beetles" *Agriotes*, *Athous*, *Dolopius*, &c., and the grubs of the cockchafer *Melolontha*.

WIREWORMS.

Wireworms occasionally do much harm in ground newly broken for nursery purposes. The damage lessens when the ground has been cultivated for some time, for the destruction during the first year or two is due to wireworms, which, having sprung from eggs laid before the bed was formed, exist already in the soil. When trees are actually growing there the parent beetles lay eggs less readily or not at all, and thus the bed is gradually cleansed.

When very young Conifers are attacked they are gnawed completely through just above the roots, and such cut plants sometimes strew the bed. Seeds are also destroyed before germination. There is a risk of the importation of wireworms in turf, earth, or possibly in manure; and associated with them in the work of destruction are the millepedes (*Iulus*, &c.) or "thousand legs," commonly confounded with them. True wireworms are hard, somewhat flattened, of a bright yellow-brown in the species under consideration; they possess twelve segments after the small head and six short legs on the first three segments. Millepedes have a varying number of segments, which may exceed forty, very nearly all of which bear *two pairs* of legs.

In one bad case of attack on seedlings which has come under my notice, in which the systematic collection of the insects was tried, the millepedes were, if anything, more abundant than the wireworms, but no observations were made as to their share of the destruction.

It is desirable to examine the ground selected for the nursery, and to reject the plot if it appears badly infested, or to cleanse it thoroughly before planting. As the acreage required is small, there should be no difficulty in doing this by methods known and practised in agriculture, such as paring off and burning two inches of the top-soil early in the autumn, or dressing with gas-lime, chloride of lime, or ammoniacal waste, and leaving it fallow till the effect of the poison has worn off. Fallow land kept clean and free from weeds during the period of egg-laying in June will

have comparatively few wireworms, but in the absence of better food these probably feed on humus, especially when young.

If seedlings are actually attacked, hand-picking is a good remedy when facilitated by the use of potatoes, carrots, or sliced mangold, laid on the ground as a bait and regularly visited. A dressing of rape-cake or mustard-cake, popular in hop-growing, may be tried, but the value of it under these circumstances remains to be proved. Serious injury from wireworm is unlikely to extend beyond the first year of growth.

CHAFER-GRUBS.

Chafer-grubs cause most damage in the neighbourhood of woods and coppices of Oak and other deciduous trees, because, though they feed underground on the roots of grass, low plants, and young trees of all kinds, the predilection of the parent chafers for such woods usually causes egg-laying to take place in their vicinity. They do not frequent Conifer woods. At the end of May and in June the females select and dig their way into the lightest available soil for egg-laying; the attack is consequently worst when Pines are grown in sandy districts.

The larvæ feed at a depth of about three inches on roots, biting away the smaller ones and gnawing the sides of the larger ones, even when half an inch thick. They retire to the depth of a foot or more from October to March, and remain under the soil for just over three years, or longer in a cold climate, changing at the end of larval life to a pupa in a cell situated from one to three feet below the surface.

The best methods of prevention consist in the encouragement of moles, birds, especially starlings and rooks, and in cleaning the ground by hand-picking when it is being broken up, afterwards surrounding it with a trench to prevent the immigration of larvæ from outside. In transplantation, when chafer-attack is dreaded, care should be taken to break up the soil as little as possible, as the female cannot burrow in hard, unbroken ground, and it is better to leave it untouched till after the flight-period is over. The beetles not only require a light soil in which to lay their eggs, but refuse to penetrate through foliage or brushwood to the ground below. For this reason a shelter-wood is especially valuable in situations and with plants where it can be adopted, and seedlings can be protected by brushwood at the time

of egg-laying. It is sometimes necessary to abandon a nursery completely if it is found to be habitually and badly attacked. A remarkable treatment recently introduced in France consists in infecting a few grubs with the spores of a parasitic fungus (*Botrytis tenella*) and "dibbling" them into the attacked soil, where the disease is said to spread among them. Tubes of the fungus are now in the market in France; and it is open to anyone who suffers from their presence to try this highly interesting remedy, the value of which has yet to be established.

Destruction of the beetles is the method on which continental foresters rely most. This is accomplished by shaking them down from the foliage of young trees on to sheets placed below; large trees must have the branches shaken separately with a long hooked pole.

The best time for the work is the early morning, and care must be taken to carry it out in weather which is not so cold and damp that the beetles refuse to drop, nor so hot that they readily fly off. They are most easily killed with boiling water, and if caught in large quantity can be mixed with quicklime and afterwards used as manure.

With the larvæ the only suitable method employed is that of digging them out. In badly infested ground the planting of Lettuce as a bait between the young trees will serve to draw them off, and they may be caught under traps of fresh bark or cut shoots stuck in the ground.

PINE-WEEVIL.

The worst enemy to young Conifers, either in a badly situated nursery or after planting-out, is the large clumsy Pine-weevil, *Curculio (Hylobius) Abietis*, a blackish-brown beetle of convex shape, with coarsely sculptured elytra sparsely decked with patches of yellow hair. The weevils lay their eggs in spring and early summer, in dead but not dry Pine or Spruce-wood, choosing especially the cut stumps of recently felled trees; also unbarked logs and the lower part of the stems of dead standing trees. Under the bark the grubs gnaw irregular galleries in the sapwood, changing at the end of these to pupæ. Like the grubs of all weevils, they require shelter, and will not feed exposed to daylight on loose brushwood, &c. They will, however, flourish in the closely packed sawdust of a saw-pit, which

will serve excellently as a focus of infection. The duration of larval life is very variable, and depends on the climate and the season. As a rule, if the eggs are laid in the spring of one year the imagos make their appearance in the summer and autumn of the year following, live through the winter and lay their eggs in the spring; or they may appear in the spring and live through the following winter after egg-laying. In any case the life of the perfect beetle lasts a year or thereabouts, and does not, as is the case with most insects, finish at the period of egg-laying. No injury whatever to growing plants of any value is done by the feeding of the grubs; it is entirely the work of the perfect beetles, which proceed on foot to young trees, preferring Pine, but also attacking Spruce, Larch, Cypress, &c., and occasionally Oak and deciduous trees when pressed by hunger.

The insects can fly, but hardly ever do so, except at pairing-time. They, therefore, frequent the neighbourhood of their breeding-places, and judicious selection of the site for a nursery away from such localities where the insect breeds will keep the trees free till they are planted out. The beetles ascend the young trees and feed on the bark of the shoots and smaller branches, gnawing out circular holes with shelving sides, which may reach the sapwood. In bad attacks these holes are placed so closely as to coalesce, and thus patches of bark are completely destroyed, the branches or the entire tree being killed. Flow of sap and of resin follows the injury, the latter being often very conspicuous. The trees chosen are usually from three to six years old, but younger ones are not rejected, and those up to fifteen years are sometimes attacked. Specimens can commonly be taken upon still older trees, and they will probably attack any tree the lower branches of which are not more than seven feet from the ground, above which height they do not ascend. They cannot injure old bark, and the damage done to trees above ten years old is usually insignificant.

The preventive treatment of this insect consists in keeping the forest as free as possible from unbarked logs and trunks, heaps of rubbish and of sawdust, and in preventing egg-laying in the stumps of recently felled areas. This is done by barking the exposed parts of stumps, earthing them over and beating down the earth, or by washing them with an arsenical wash, either

of sodium arseniate, Paris-green, or London-purple. Owing to the deficient penetrating power of the two latter, which do not form a solution, but are held in suspension by the addition of dextrine or flour, the soda-salt would probably be preferable. Care should be taken to apply such remedies before egg-laying has taken place, and the spot to be protected is chiefly the junction of the wood and bark. The Paris-green or London-purple washes can be used stronger than for living plants, for which the strength should never exceed one ounce to ten gallons of water. No advocacy of arsenic applied to stop insect-depredations is complete without the reminder that all buckets and other apparatus applied to that use should be kept solely for that purpose, and should be carefully destroyed when done with; no scouring should be trusted to free them from arsenic. If they are carelessly employed for other work, a serious accident will some day discredit this most valuable method of dealing with injurious insects.

The best check of all on the propagation of this insect is to clear out the stumps, for when there are no breeding-places there can be no beetles. As these insects breed in and frequent the neighbourhood of fresh clearings, they gradually die out if there is no surrounding dead wood for egg-laying; this will be the case if the felling areas are adjusted so that adjoining sections have an interval of several years (at least four) between the periods of cutting, no section being felled close to one previously cut and planted till the new trees are well started. This can always be managed by reducing the size and increasing the number of areas; and if the forest-plan is carefully drawn out with that view, the absence of the beetle will more than compensate for the slightly increased trouble.

Curculio Abietis always does most harm when areas are cut and planted in regular succession, so that every space covered with young trees adjoins one covered with fresh stumps, from which the weevils sally forth to the work of destruction.

Young plants can be protected by surrounding the base of the stem with dry earth beaten flat with the spade, or with gas-lime or similar compounds, or by "grease-banding" the base of the stem, and in the case of Spruce, by planting with them a few Pines, which will be attacked in preference. If the area planted is clean, beetles can be prevented from entering it from outside

by surrounding it with dry trenches with vertical sides about a foot deep. Into these they drop, and can be collected in large numbers, especially if brushwood be placed at the bottom.

Other methods of attracting the beetles themselves are by laying traps of Pine-bark on the ground with the inner side downwards, shoots and fresh brushwood tied in bundles, or loose logs, and by digging holes about a foot deep and filling them with fresh needles and brushwood.

Whichever method be adopted, the traps must be visited and cleared of beetles regularly, or they will do more harm than good. This is true of all natural baits to attract insects.

PISSODES.

Two insects which somewhat resemble *Curculio Abietis* deserve passing mention; these are the beetles of the genus *Pissodes*, *P. Pini* and *P. notatus*. Both are supposed to be confined to the North of England, and to Scotland. There is a doubtful record of *P. notatus* from Bournemouth, and I have myself found it in the New Forest. It is likely to occur in any artificially formed Pine-plantation if the young trees have been imported from a locality which it frequents. Neither species is very common, but *P. notatus* at least has been reported as injurious in Scotland. The weevils are smaller than *Curculio Abietis*, more variegated in colour, and the thighs are not toothed. They lay their eggs on Pine-trunks, and the larvæ feed under the bark where they hollow out pupal chambers. *P. notatus* attacks young trees from three to six years old, *P. Pini* older trees. The injury caused by both is to be met by careful removal of attacked trees and others which, being sickly, are liable to cause attack, and by selecting sites for nurseries so that the trees shall enjoy good general health. They do most mischief to Pines planted in unfavourable situations.

PINE-SAWFLY.

As the trees grow up they suffer less from *Curculio Abietis*, but new enemies arise, especially defoliating larvæ. In Great Britain, in the absence of damage from *Gastropacha Pini* or *Liparis monacha*, the most important of these are the Pine-sawflies, *Lophyrus Pini* and other species of similar habits. The females in late spring cut a longitudinal slit in a Pine-

needle and lay in it from 10 to 20 eggs, repeating the process on the adjoining needles till about 120 eggs have been deposited. The larvæ hatch in a fortnight or rather more, and live together in small companies on Pine-shoots, feeding on the needles, from the midribs of which they strip away the sides. They fortunately confine their attacks to the older needles, and not to the young ones of the first year. Towards the end of their two months' life they devour the needles completely, disregarding the midrib. They are caterpillar-like, with 22 legs, and are somewhat variable in colour, being usually lighter or darker green, darker along the back, with a blackish head and a lateral series of black spots. After five or six moults each larva makes a very small oval cocoon of leathery texture in rubbish at the foot of the tree, or in moss, &c., under the surface of the layer of needles on the ground. In warm countries, and with us in warm seasons, a second brood of flies appears from these cocoons in August and September, and in the autumn their larvæ feed up, very largely on the needles of that year, which are then suitable for food, and remain in shelter throughout the winter in their cocoons, not actually changing to pupæ till about three weeks before the flight-time. The winter period is always passed in the cocoon by the summer larvæ if there is no autumn brood.

The larvæ can be destroyed by shaking them down on to cloths and there killing them, or they may be crushed *in situ*, by grasping them with a gloved hand or a wad of tow, or with a metal implement like a pair of scissors, with two large flat blades meeting face to face.

They can also be killed by spraying with a solution of hellebore, or sprinkling it on as a powder, but better results would be got by the use of Paris-green, as for fruit-trees. The expense of this treatment is not great; low fruit-trees are sprayed for about 7s. to 10s. per acre, exclusive of the prime cost of the machine used. A hand-machine which will spray trees up to 14 feet in height can be bought for less than £3; it requires two men to use it. Apparatus of this sort should find its way into every large nursery where occasional trouble from defoliating or other insects is experienced. The objections to the use of arsenic on fruit-trees do not apply here, except when there is risk of injury to game.

The pupæ of *Lophyrus* can be destroyed by raking up the

brushwood and upper layer of needles under the infected trees in the winter with the contained cocoons, and conveying to a spot where it may be safely burned. A very serious objection to this plan is that it deprives the soil of its natural surface-covering of needles, and if persisted in for a long time it will injure the health of the trees. It should not be resorted to without good cause, and when other remedies cannot be adopted. The removal of brushwood, &c., as opposed to this covering of needles, is always valuable for the prevention of insects.

There are a large number of other defoliating insects common in England, as the moths *Fidonia piniaria* and *Trachea pini-perda*, which are rarely, if ever, reported as doing noticeable damage. They are occasionally very common, more particularly the former, and it remains to be seen if their presence does not sometimes tell injuriously on the trees. A favourite device of the continental foresters to keep down caterpillar-attack is that of letting swine run loose in the forest. They are zealous searchers for and devourers of all pupæ and larvæ which come within their reach ; but, unfortunately, the cocoons of *Lophyrus* are too leathery to be attacked by them.

LARCH-MINER.

A special form of injury is that inflicted on Larch-needles by the larvæ of a tiny moth, *Coleophora laricella*, which lays its eggs at the end of June on the needles of the lower branches of Larches about ten to fourteen years old. The caterpillar mines into and feeds upon the interior of the needle, which becomes dry, yellow, and twisted ; it then bites off the tip and detaches the needle about its middle, so as to form a tube in which it lives and passes the winter, concealed in a crack or under a bark-scale. In the spring it feeds on the new needles, and enlarges its tube by spinning a fresh needle along its side, biting it off and hollowing out the adjacent surfaces ; in this tube it changes to a pupa, and ultimately to a moth. This insect is common in many English Larch-plantations, whose foliage, when the attack is bad, has a dull, withered look which is very conspicuous ; it does not kill the tree, but keeps it year after year in an unhealthy condition.

Practical treatment is difficult ; picking off the injured shoots is very troublesome, and the only successful plan is to remove

badly attacked trees, and burn the foliage before the moth flies in June. It is best prevented by growing Larch in a suitable mixture, and not in pure woods. Special importance attaches to this and other Larch-feeding insects because the wounds which they make probably serve as a nidus for the spores of Larch-canker.

The insects which cause destruction to the shoots are chiefly the caterpillars of the genus *Retinia* and the beetle *Myelophilus* (*Hylesinus*, *Hylurgus*) *piniperda*.

The *Retinias* are small moths belonging to the group *Tortricina* (Leaf-rollers), of oblong form, reddish brown or grey in colour with somewhat elaborate markings of paler streaks and bands, assimilating in tint to the colour of Pine-bark of different shades, a feature specially characterising Conifer-feeding moths.

PINE-SHOOT MOTHS.

By far the most important species in Great Britain is *Retinia buoliana*, though the scarcer *R. turionella* has got more credit as an injurious species; it is equally destructive in habits.

R. buoliana appears at the beginning of July, *R. turionella* some three weeks earlier.

Both moths lay their eggs singly on young Pines at the base of the buds of the terminal shoot or lateral branches; into these the caterpillars bore, hollowing out the centre bud, and then attacking the lateral buds in the same way so as to destroy the whole or part of the terminal whorl. The larvæ live in the shoots through the winter, and pupate there in the spring. Their presence is easily recognised by the altered and stunted shoots which have failed to grow, and break off at a touch, as well as by the flow of resin caused by the feeding, especially of *R. buoliana*.

The effect on the tree of the loss of the terminal shoot has been already mentioned; the lateral branches injured by *buoliana* subsequently grow twisted, and take on a characteristic curved "post-horn" shape which lasts for many years after the injury.

These insects suffer, fortunately, from the attacks of many parasitic enemies, for practical treatment has met with little success. The infested shoots have been persistently cut off and burned for many years in succession without real benefit resulting; this treatment is only applicable to small isolated areas,

and should be tried during the month before the appearance of the moths. Egg-laying takes place in the evening, and it is sometimes worth remembering that the moths can be kept off small patches of trees which it is important to preserve by lighting weed-fires to windward, so that the smoke will drift over. This is not capable of extended application, but may be employed to protect ornamental trees which sometimes suffer severely in the neighbourhood of large Pine-woods. These insects are most troublesome when trees are crowded together, neglected, and grown on unsuitable soil, and, as is usually the case, when the wood is not mixed.

PINE-BEETLE.

Myelophilus (Hylurgus) piniperda, the *Wald-gärtner* or Pruner of the German foresters, is, next to *Curculio Abietis*, the most injurious insect to Pines in Great Britain, over the greater part of which it is very abundant. There are, however, many districts where it does not occur, or has not been observed, but almost any Pine-wood will yield evidence of its presence to a careful searcher. It is a small oblong brown beetle of the family *Scolytidæ*, or Bark-beetles.

The female, about the beginning of April, chooses a tree for oviposition. Those selected are newly dead or dying Pines, especially freshly felled timber, unbarked logs and stumps, or trees injured by storms, snow, or fire; they must have the bark on, and are preferred as fresh as possible, provided that the sap is not actually circulating. Occasionally the beetles make use of Spruce, and, according to Dr. Somerville's observations, of Larch. She commences boring under a projecting scale, where the bark is thick, often on the under side of a fallen trunk, if it is free from the ground, and excavates a gallery in the bast running, with the exception of the entrance which is oblique, along the axis of the trunk. It is from three to four and a half inches long, and takes from three to five weeks to construct.

The eggs, which may reach 120 in number, are placed in small hollows excavated alternately along its two sides. They hatch in a few days, and the larvæ begin to construct lateral galleries at right angles to that of the mother. The larval galleries are at first small, but increase in size with the growth of their inmates and soon take an irregular course.

The larvæ, when full-grown, change to pupæ in a small cavity hollowed out in the bark at the end of the burrow, and appear as perfect beetles in June or July, emerging from the tree by eating out a circular exit-hole from the pupal chamber. Those which hatch from the first-laid eggs are considerably in advance of the grubs coming from eggs laid at the end of the five weeks' task of the mother, whose dead body can be found at the end of the burrow. The borings of the parents are not at first conspicuous, but can be detected later by the dust thrown out from between the scales of bark, whereas the holes made by the exit of the beetles, which are in no way concealed, at once indicate that they have bred in the trunk.

It appears from Dr. Somerville's observations that the beetles which appear as early as June breed at once, and a second generation is produced in September. The harm done by the breeding of this insect is not great, as, like *Curculio Abietis*, it commonly avoids healthy timber. They do sometimes attack sickly trees, and I believe that they not unfrequently complete the destruction of isolated wind-swept clumps of Pine-trees. But the special form of injury done to Pines consists in the boring of the mature beetle into the young shoots for feeding purposes. This is effected by making a lateral hole in the shoot at a distance varying from one to five inches below its tip. This hole becomes marked with a circular ring or collar of exuding resin, and from it there is bored a burrow for about an inch up the pith of the shoot, which is killed, or, if the burrow is only partially completed, crippled. These shoots break off readily above or through the entrance-hole, and strew the ground after a high wind. Their loss, repeated year after year, produces a striking change in the appearance of the tree, which loses its compact crown and becomes "stag-headed," the foliage being thin and scanty, and dead branches sticking out. It is also liable to the attacks of other insects, and to fungoid diseases.

At the beginning of winter the beetles quit the shoots, as a rule, and hibernate in moss, &c., or in small burrows made in the thick bark at the lower part of the trunk. The great treatment for this insect, as for so many others, consists in not leaving timber in the woods for the beetles to breed in—that is to say, during the months from April to July—whether it be felled in due course or destroyed by accident. If it is left till

not later than the middle of June and then carted away, and the bark stripped and *burned* before the beetles have emerged, it will serve to greatly diminish the numbers of those present. For this special purpose traps may be established, which consist of standing trees ringed about February; after the beetles have entered these, and are egg-laying and breeding in the bark, they are cut down, and the bark is destroyed, as mentioned above, before the larvæ hatch out. Great care must be taken to see that such bark is destroyed by the proper time, or the whole result will be to increase the number of beetles present in the forest. All stumps and dead wood left *in situ* should be barked; and sickly trees should be cleared away before they have actually become a prey to the larvæ, unless they are to be used as tree-traps. Much labour has been expended in clearing up the blown-down shoots from the ground and in searching the trees for those branches which contain holes. Neither plan is commendable. The blown-down shoots are almost invariably empty, and if the latter very troublesome method be adopted, and the shoots are picked off and collected into a receptacle, it will be found, when they are carried off to be burned, that the beetles, if originally present, have all escaped.

Other species of bark-beetles like those of the genus *Hylastes*, which sometimes attack the roots of young trees—*Tomicus sex-dentatus*, *acuminatus*, *Laricis*, *chalcographus*, and *bidentatus*, all of which may occasionally prove troublesome—are to be treated in the same way by the clearing out of brood-material, and, if necessary, by the establishment of "tree-traps."

It is to be noted that *Myelophilus piniperda* never breeds in the shoots where it feeds, and certain cases recorded where it is supposed to have done so are due to a confusion between its larvæ and those of *Retinia*, or of certain other beetles (*Ernobius*, &c.).

A peculiar form of injury is that caused by the sucking of the two kinds of *Chermes*—the Spruce-gall aphis, *C. Abietis*, and the Larch-aphis, *C. Laricis*. These insects, near neighbours of the *Phylloxera*, have recently attracted much attention owing to the peculiarities of their life-history, which have been investigated by Blochmann, Dreyfus, Cholodovsky, Löw, and Eckstein. A *résumé* of all the recent papers on the subject would be beyond the scope of the present article, and, indeed, all the results are by no means certain, and a brisk controversy has

been waged over them. Yet sufficient is known to have a very distinct bearing upon practical forestry.

SPRUCE-GALL APHIS.

On the Spruce the *Chermes* appear in the spring as short, oval, wingless insects of an ochreous colour, furnished with a bristle-like rostrum. They have passed the winter in crevices and under bark-scales, and early in April attach themselves each to the base of a young leaf, which reacts by a small swelling. These forms are parthenogenetic females, the foundresses of the colony, and lay a mass of eggs at the spot (generally at the junction of two branches) to which they attach themselves. The larvæ, hatching, penetrate the surrounding parts of the shoot with their beaks; the shoot swells, as do the bases of the needles, and a growth commonly known as a "Pineapple-gall" or "Spruce-gall" results. This gall somewhat resembles a small Fir-cone about an inch long, with the surface divided into small convex areas, each bearing a short needle-like projection in the middle; these are deformed needles, which, becoming swollen, touch each other on the outside of the gall, but which are separate inside, so that the gall contains a series of cavities or chambers. In these cavities the larvæ live in numbers, either entering the chambers during the growth of the gall or being enclosed by the swelling of the surrounding needles; on this point there is a difference of opinion.

The galls sometimes completely surround the base of the shoot, sometimes they are only developed on one side. The larvæ are closely packed in the chambers, from twenty to fifty being found in each one. When they are fully grown in August they acquire wings and leave the chambers by apertures left by the shrinking apart of the leaves. These insects are winged females, and their special function is that of spreading the species on to other trees. The effect of the galls on the tree is to cause crippling of the attacked shoot, and when they are abundant the general growth of the tree is much impaired.

LARCH-BUG.

The females of *Chermes Laricis*, which also pass the winter under bark, &c., appear in the spring like those of *C. Abietis*;

they also are wingless, oval, of small shape, and of a purplish-black colour, and have a long bristle-like sucker with which they penetrate the needles to feed on their sap. Towards the end of April they lay forty to fifty eggs on the twigs. The young produced scatter themselves over the needles, and do not live enclosed in a gall; at first very minute and blackish, they grow rapidly and become covered with a whitish woolly down exuding from pores on their body, giving the trees the appearance of being covered with minute scattered snow-crystals. About June they acquire wings and spread the species, while further broods are produced till the autumn. This insect occurs on Larches of all ages, being found, perhaps, most frequently on trees of ten to twenty years old; it not seldom affects young Larches in nurseries, and may there be very troublesome.

The facts thus briefly given about the two kinds of *Chermes* are those which are commonly known and recorded. It will be seen that nothing is said about the presence of any male forms or of a sexual generation; and, indeed, till recently nothing was accurately known about the existence of the male. In 1883 Mr. Buckton detected the very minute wingless male of *C. Abietis* in England, and somewhat later the series of papers by German observers already referred to have thrown much light on the life-history of these insects. It may be taken as proved by them that *Chermes Abietis* and *Laricis* are different forms of one and the same species which migrates between two food-plants, certain stages in the life-cycle being passed on the Spruce, certain stages on the Larch. Such instances where the full cycle of forms is not completed in one generation are not unknown amongst other insects, especially among the *Aphides*, while the *Phylloxera*, nearly allied to *Chermes*, supplies us with a familiar and striking case. Similar examples are furnished by other parasitic animals and plants, notably the tapeworms and liver-flukes, and the *Puccinias* (*Æcidiumycetes*) among fungi. These life-cycles are usually associated, as in the instances referred to, with a change of host, or, as in the *Phylloxera* of the Vine, with change of situation on the same host; that is, certain generations in the life-cycle are always passed on or in one host, other generations on another host, and it is commonly found among insects that the complete cycle comprises one sexually produced generation, which may be said to start the cycle, and numerous

parthenogenetic generations produced from female forms by viviparous "budding" or the laying of unfertilised eggs. The host on which the sexual generation is found, which probably represents the primitive food-plant of the species, is spoken of as the "primary host" or "primary food-plant," the other being the "intermediate food-plant." In *Chermes Abietis-laricis* (as these insects should henceforth be called), the Spruce, upon which the sexually produced egg is always laid, is the primary food-plant, the Larch is the intermediate food-plant.

The cycle given for these insects by Dreyfus is as follows:—

First Year.

Generation I. passes the winter on the Spruce as *Chermes Abietis*, and there lays eggs.

Generation II. develops in the Spruce-galls, and emerges as the winged forms of *Abietis* in August. Part of these emigrate to the Larch, and, being now known as *Laricis*, lay eggs on its needles.

Generation III. hatches on the Larch, and passes the winter under bark-scales, &c.

Second Year.

From the eggs of Generation III. appear Generation IV. (the woolly form of *C. Laricis*), which acquire wings at the end of May, and mostly return to the Spruce. There they are known as *C. obtectus*,* and their eggs produce

Generation V., the bisexual, consisting of true males and females. From their sexually produced eggs develop gradually from July to September the "Stem-mothers," which live through the winter and correspond to Generation I. of the cycle.

Blochmann, who contests with Dreyfus the priority of these discoveries—a dispute into which it is not necessary to enter—gives a life-history differing in the presence of a second gall-inhabiting generation, and an additional one passing the winter on the Spruce. These two generations will be interpolated between I. and II. of the cycle just quoted, and the whole series will extend over three years. The exact number of generations is, however, not important in practice, and it is sufficient

* This form appears to be as yet unrecorded from Great Britain, and its identification with the remigrant form of *C. Laricis* is disputed by Blochmann.

to know that migration does occur, that the Spruce is the primary host, and on it is found the sexual generation. No males of *C. Laricis*—that is, no male forms on the Larch—have as yet been detected, and, if the life-history given is correct, there is little reason for supposing that they ever will be.

If this alternation of host, or “heterœcism,” were merely an interesting biological fact, it would have no place here, but all such cases have an important practical side, whether they occur among tapeworms, Wheat “rust,” Hop-aphides, or *Chermes*; and the following questions immediately suggest themselves as a result of the study of this life-cycle:—

As the species alternates between Spruce and Larch, is it specially injurious to either tree when the two are growing in company, as in a Spruce-Larch mixture?

Can it support itself on, and injure Spruce when there are no Larches in the neighbourhood?

Can it support itself on Larch when there are no Spruces in the neighbourhood?

These questions cannot at present be fully answered, but it is obvious that their solution can be furthered by anyone who has large opportunities for studying the two trees growing together and separately, and who is able to identify the “Spruce-galls” and the “woolly-bugs” on the Larch-needles. No further entomological knowledge is necessary, and it is to be hoped that light will be thrown on the subject by practical men; for it is by the accumulation of evidence that the real practical importance of the question must be decided.

In the papers already published more attention is paid to the biological problems involved, but Blochmann says distinctly that the first protective measure to be adopted is that of not growing the two trees in company. In certain woods, where a mixture of Spruce, Larch, and Pine was growing, he has observed the galls so abundant on the Spruce that scarcely a twig was free. In others, again, where the Spruce-plantations were almost entirely free from Larches, there were large areas in which no galls could be discovered, and he is strongly of opinion that the abundance of Spruce-galls is correlated with the supply of Larches, on which the *laricis*-form can live. At the same time he admits that Spruces can be infected at a distance by the insects being carried by wind.

Dreyfus, on the other hand, takes a different view, and points out with much probability that there are two parallel series of life-cycles, a feature occurring perhaps with the majority of insects with a cyclical life-history, and one which will serve to explain many of the anomalies found, for example, in the *Phylloxera*. By these "parallel series" he means that all the members of one and the same generation do not migrate similarly, but have somewhat different habits and offspring, and that thus two different lines of descent are formed which converge later to the same point, the generation from which the next cycle starts. Thus, according to him, the whole of the winged forms of *C. Abietis* do not migrate from the Spruce, but a certain percentage remain to lay their eggs on it, and thus a series of generations is established which live exclusively on the Spruce. In support of this he mentions collections of young Spruces crippled with galls, in whose neighbourhood there is only one solitary Larch some way off, which is not very thickly infested with *C. Laricis*. He has also never seen a specimen of *C. Abietis* fly away from these infected trees, and he even thinks that *C. Laricis* remaining on Larches may possibly achieve a bisexual generation. Löw points out that in Lapland, where the Larch does not grow, *Chermes* certainly exists—perhaps only another species (*C. strobilobius*)—and its migration must therefore take place on to the Pine. Such migration Cholodovsky claims to have observed.

The necessity, therefore, of the conjunction of the two trees for the support of these insects cannot be taken as proved, and the questions proposed above have still to be answered.

Here in Great Britain the fact of the two trees being introduced, and not indigenous, has caused an irregular distribution of them, which affords many opportunities for observations on this subject. May we hope that they will be seized?

It does not follow because Spruce is not protected by isolation from Larch that the converse is not true, because the Spruce is undoubtedly the primary host of these insects, and there is less probability of their being able to do entirely without it; and in any case young trees in a nursery must be infected from outside, and preferably from a tree of the opposite species. It would therefore answer to try the experiment of growing Larches and Spruces in separate nurseries, away from communication with each other or from older trees of the opposite species, and it

should be remembered that a better protection than separation by a mere open space against the immigration of these insects from distant trees is afforded by an intervening belt of trees of a different species, as, for example, deciduous trees. If anyone who has been troubled with the Spruce-gall aphid and the Larch-bug in his plantation will endeavour to make separate nurseries of the two trees, isolated in clearings of deciduous trees, his experience of success or failure in thus keeping away *Chermes* will be most instructive.

As to the practical treatment of infested trees little can be done, at least when they are moderately large.

On the Spruce the galls can be snipped off before they have allowed the insects to escape in August; but the remedy is a troublesome one to adopt. They should be carefully burned after gathering. If trees, especially avenue or ornamental trees, are laden with galls, they had better be completely removed, as the result will be serious stunting and deformity.

The experiment of washing the Spruces in April before the gall has grown would probably lead to good results, and this is the best plan to adopt in the case of the Larch-aphid.

The ordinary washes of kerosene ("paraffin oil") and soft-soap are perhaps the most suitable, though they are not always quite successful. The resin washes used in America are also worthy of a trial. The formula is:—

Resin	...	...	...	...	20 lbs.
Caustic soda (70 per cent.)	...	...	...	...	6 "
Fish oil	...	...	...	...	3 "

The ingredients are placed in a kettle, covered with water, and boiled till saponified. Warm water is gradually added till the mixture is made up to 100 gallons. Any common animal oil can take the place of fish oil, and it will be seen that the constituents are similar to those of common yellow soap with the resin in excess. This is, in fact, what the wash is, and it can probably be modified by using hard soap instead of oil, and somewhat reducing the amount of caustic soda.

Additions of tobacco-water, &c., to ordinary soft-soap wash have been made and used, but are probably unnecessary. Washes of dilute corrosive sublimate have also been tried with some success, but no washes are proper to use against sucking insects (*Aphides*, &c.), unless they contain soap, oily matters,

or hydrocarbons, which will enable them to spread over the surface of the plant on which they are sprayed. For these insects arsenic should not be used.

There are many insects which take possession of the dead or dying tree to lay their eggs therein whose larvæ burrow into and penetrate the wood, making it useless for commercial purposes.

Of these the most important are the wood-wasps, *Sirex gigas* and *juvencus*, large Hymenoptera of elongate shape. *S. gigas* is yellow-and-black, and of a decided wasp-like appearance, while *S. juvencus* is deep blue, with the middle segments of the abdomen reddish in the male.

WOOD-WASPS.

These insects appear to be somewhat widely distributed in Great Britain and Ireland, and are occasionally not rare. To judge, however, from the way in which entomologists think it desirable to record the specimens which come under their notice, they can hardly be described as generally common. Owing to their striking appearance and loud buzz in flight, they attract general attention, and are probably as rarely overlooked as any indigenous insects. Not a few recorded specimens are obviously imported in foreign timber. The females of both species lay their eggs on Conifer-wood exclusively, choosing, as is so often the case, sickly or dying trees, or those that are actually felled or dead. *Sirex gigas* appears to attack principally the Spruce and Silver Fir, sometimes the Larch and non-European Conifers like the Deodara.

According to German observers, it does not touch the Scotch Pine, and I have seen no English statements to contradict this. Unfortunately, it is often impossible to make out exactly what species of Conifer is referred to by English entomologists.

Sirex juvencus, on the other hand, attacks the Scotch Pine freely, as well as the Spruce, Silver Fir, and Larch.

The eggs are deposited in cracks running through the bark into the sapwood, or in holes made by the strong ovipositor, and not rarely on patches of bare wood where the bark has been torn off by accident. This sometimes gives an opportunity for injury to otherwise healthy trees. The larva, whose life extends over two years, is a stout, elongate white grub, readily distinguished by an upwardly directed point on the last segment; it bores

obliquely towards the heart of the tree in the long axis of the trunk, making a gallery which gradually increases in size, and eventually turns and approaches the surface. At the end of this gallery it changes to a pupa, separated from the outside only by a thin layer of wood or bark, which is gnawed through by the imago upon emergence. The time of development of the larvæ is increased by drying of the wood; and if timber containing larvæ is cut up into planks, the insects may eventually emerge in the interior of buildings, &c., and in that case are stunted and small.

The larval jaws are exceedingly powerful, and they have often been known to eat through lead—as in the Crimean war, when bullets were found to have been penetrated by larvæ emerging from the unseasoned wood of the ammunition-boxes. A still more remarkable instance is that of the boring of the larvæ of *S. gigas* from the timber supports into the lead-chambers of sulphuric-acid works, so as to let out the dilute acid. It is by this injury to otherwise sound timber that the insects are important, but they occasionally complete the destruction of Conifers that would perhaps have lived several years longer.

The only remedy against their attacks in a wood which they inhabit consists in careful removal of all infected trees, which are sometimes indicated by the attacks of woodpeckers, and other dead or dying wood in which they can and do breed. Standing trees which have lost patches of bark by accident should have the wounds tarred over or dressed with a plaster of lime, cow-dung and clay, or other suitable mixture. Timber, when felled, should be removed before the imagos appear in summer.

These remedies are also suitable to ward off the attacks of wood-feeding longicorn beetles, as *Acanthocinus ædilis*, *Callidium violaceum*, &c., which may do a certain amount of damage in a very similar manner.

If the foregoing particulars are summarised it will be seen that the enemies of the Pine in Great Britain are far more numerous and important than those of any other Conifer. Of the sixteen or more species referred to in detail, twelve at least attack the Scotch Pine, and of these eight are confined to that tree, and to foreign species of *Pinus*. The Spruce shares its particular pest, the gall-aphis, with the Larch, which has a

special enemy in *Coleophora laricella*. Silver Fir is liable to injury from wood-wasps, but does not exclusively support any important species. This liability of the Pine is no doubt due to its being the only forest Conifer indigenous to Britain, where the Spruce is as yet free from the serious enemies which attack it over the greater part of Europe.

The preventive measures to be adopted against insect-attacks can be gathered from what has been said, but it is necessary to again point out, at the risk of being tedious, that no Conifer-wood can be kept free from the risk of insect-injury, unless it is freed from newly dead and dying wood, cut branches, and fresh stumps. There is no need for the systematic removal of the covering of needles, the natural protection to the ground, nor, as a rule, of small twigs and branches much under an inch in diameter.

It is not rarely objected by those anxious to free a wood from insects that this thorough cleaning is too costly to be put into practice. Without it the insects cannot be kept down, and it is for them to look at the cost of labour and the opportunity for disposal of such timber, and decide whether it is cheaper to let the insects flourish or not.

The first cleaning-up of a neglected forest is no doubt costly, but after that has taken place there is plenty of evidence to show that systematic and orderly removal of dead wood is profitable in the long run, unless exceptional destruction of timber over scattered areas by storms or snowfall should unduly strain the forest resources.

No one who is familiar with the pitiable appearance of a Pine-wood thinned out badly by *Myelophilus piniperda* can doubt that in this matter penny-wisdom sometimes leads to pound-foolishness, and that in the end the practice of keeping the forest thoroughly clean—a practice advocated for many generations by scientific foresters—is the best and safest.

LIST OF CONIFERS AND TAXADS

IN CULTIVATION IN THE OPEN AIR IN GREAT BRITAIN AND IRELAND.

By Dr. MAXWELL T. MASTERS, F.R.S., Corresponding Member
of the Institute of France.

INTRODUCTION.

Objects of the Compilation—Authorities cited before and after the date of Parlature's Monograph (1868)—More Recent Bibliography—Abbreviations—Living Specimens examined—Herbarium Collections—Nomenclature—Synopsis of Tribes and Genera—Alphabetical List of Genera and Species.

THE following list comprises an enumeration of all the Conifers and Taxads known to be hardy in our islands, together with the names of a few others grown under glass and which may be of importance for naturalisation in some of our colonies.

In drawing up the list of genera, Bentham and Hooker's "Genera Plantarum" has been followed as the standard authority. A few deviations from it have been made in accordance with more recently obtained knowledge.

Parlature's monograph of the Coniferæ in De Candolle's "Prodromus" has been taken as the basis for the enumeration of the species, but with considerable modification. This monograph is cited throughout because it is the most complete of any up to the date of publication (1868), and especially because it is very rich in references to books and to figures. In consequence it has in many cases not been deemed necessary to cite full bibliographical details, but merely to refer the reader to the volume of the "Prodromus" in which the desired information may be found.

More complete reference has been made to illustrated books, and to works published since the issue of Parlature's monograph (1868); but as the requirements of cultivators have been the main points attended to, references of value to botanists and physiologists only have been sometimes passed over.

The costly "*Pinetum Britannicum*," published originally by P. Lawson & Co. and brought to a close a few years since by Mr. Ravenscroft, with the assistance at various times of Robert Brown, Lindley, and especially of Andrew Murray, has been quoted throughout. The lattermost sheets of this great but sadly incomplete book were prepared by the present writer, at Mr. Ravenscroft's request, in order to fulfil the obligations to the original subscribers. That task was accomplished, it is to be feared, at great loss to the proprietor. The death of Mr. Ravenscroft has put an end to the idea, at one time entertained, of publishing an abridgment of the existing work, with a continuation completing the history of the Order, and materials for which have been collected by myself.

Loudon's "*Encyclopædia of Trees and Shrubs*" (1842) is quoted by reason of the numerous woodcuts, copies from Lambert's costly work, and also others from original sources, that it contains. In these respects it is more complete than the "*Arboretum*," which was published earlier; moreover, a more recent edition or reproduction has been issued.

The treatises of Endlicher, Gordon, and Carrière have, of course, been consulted, although, for the reasons above given, they are not always specifically quoted.

Hoope's "*Book of Evergreens*" (1868), an American work, well illustrated, deserves to be known here more widely than it is.

Veitch's excellent "*Manual of the Coniferæ*" (1881) has been cited throughout, not only on account of its general accuracy, but because of its ready accessibility and wide distribution among gardeners.

Beissner's "*Handbuch der Nadelholzkunde*" (Berlin, 1891) is well illustrated, and for the most part complete and accurate so far as the species hardy in Germany are concerned. The list of varieties it contains is also valuable for garden purposes.

It is hardly necessary to allude to those European floras which have been dealt with in the older books, but among more recent productions may be mentioned Willkomm's "*Forstliche Flora*," 2nd edit. (1887), an excellent manual of the forest trees of Germany, and one in which many Conifers are figured; Velanofsky, "*Flora Bulgarica*" (1891), and Blanchet, "*Catalogue des Plantes vasculaires du sud-ouest (Pyrénées, etc.) de la France*"; whilst several Conifers are figured in the "*Flora Forestal Española*,"

by Laguna and Don Pedro de Avila (1881). The latest enumeration of European Conifers is that in Richter's "*Plantæ Europææ*," vol. i. (1890), pp. 1-7.

For the North American species, exclusive of those of Mexico and Central America, Sargent's list of forest trees in the Tenth Census Report (1884) is invaluable for its elaborate synonymy, copious references to literature and to illustrations, extended details of topographical distribution, together with indications of economic uses, etc.

Coulter's "*Manual of the Botany of the Rocky Mountains*" (1885) deals with the Conifers of that range, and the Californian species were enumerated in the second volume of Watson's "*Flora of California*" by the late Dr. Engelmann (1880). Lemmon's second and third "*Biennial Reports of the California State Board of Forestry*," for the years 1887-88 and 1889-90 respectively, are very valuable as containing numerous and important observations on the living trees and their distribution, together with photographs, &c.; but, unfortunately, these Reports are not generally accessible to gardeners.

Macoun's "*Catalogue of Canadian Plants*," vol. i., part 8 (1886), contains a complete list of the Canadian species, Pacific as well as Atlantic, with a full account of their distribution.

A catalogue of Mexican and Guatemalan species is given by Hemsley in the "*Biologia Centrali Americana*," vol. iii., p. 188 (1886).

The few Moroccan species were enumerated by Ball in the "*Spicilegium Floræ Maroccanæ*" in 1878 (*Journal of the Linnean Society*, vol. xvi., p. 669).

Boissier's "*Flora Orientalis*," vol. v. (1884), contains a descriptive enumeration of all the Mediterranean, Levantine, Persian, and Caucasian species, as well as those of Afghanistan and bordering countries.

For Indian species, Sir Joseph Hooker's "*Flora of British India*," vol. v. (1888), summarising as it does the labours of Wallich, Griffith, Wight, Brandis, and many other Indian botanists, and giving references to their publications, has been followed.

For the species native to Japan I have consulted not only the *Flora* of Siebold and Zuccarini (1842), but the later works of Murray on the Pines and Firs of Japan (1863), Franchet and

Savatier's "Enumeratio" (1875), my own monograph in the "Journal of the Linnean Society," vol. xviii. (1879), p. 473, as well as the more recently published monograph of Japanese Abietinæ by Dr. Mayr (1890).

The Chinese species have been enumerated in a monographic list (not yet published), prepared by myself, to form part of Forbes and Hemsley's very useful enumeration of all the plants known from China proper, and which is now in course of publication in the "Journal of the Linnean Society."

The "Forest Flora of New Zealand," by Professor T. Kirk (1889), contains numerous illustrations and excellent descriptions of the peculiar species native in those islands, some of which are grown here as greenhouse shrubs, and some of which are also likely to be of great importance in countries suited to their growth.

Few Australian species come within the scope of this list, but some are grown in our conservatories. The "Flora Australiensis" of Bentham gives details concerning them, and a full list, with references, is given in Baron Sir Ferdinand von Mueller's "Systematic Census of Australian Plants." For species of economic importance and suitable for extra-tropical culture the reader should consult that author's useful "Select Extra-Tropical Plants."

To obviate unnecessary repetition and to save space, the full titles of the works alluded to in the following list are only cited in exceptional instances, thus:—

"Benth. et Hook." signifies in all cases the monograph of the genera of Conifers prepared by Mr. Bentham in Bentham and Hooker's "Genera Plantarum," vol. iii., p. 420 (1880).

By "Eichler" is meant the similar recension of the genera by the late Professor Eichler in Engler and Prantl's "Die natürlichen Pflanzenfamilien," 2. Teil, 1. Abtheilung (1889).

The name "Parlatore" always applies to the monograph of Coniferæ prepared by the Italian botanist for De Candolle's "Prodromus," vol. xvi., part 2 (1868).

"Veitch" applies exclusively to the Manual of Coniferæ in which his assistant, Mr. Kent, took so large a share, and which was published in 1881.

"Beissner" is a brief citation for that author's "Handbuch der Nadelholzkunde" (1891).

"Pinet. Brit." refers to the "Pinetum Britannicum" of Ravenscroft previously alluded to.

References to well-known treatises of older date are given in the books just alluded to, and are not in all cases repeated here; but the more recent ones, and those not quoted in the text-books, so far as they are of importance to cultivators, are cited at length in the list now given.

In addition to literary materials, I have had at hand constantly during the preparation of this list collections of dried specimens made by myself during the last few years, through the kindness of the authorities of the Royal Gardens, Kew, the directors of many of our botanic gardens at home and abroad, and through the courtesy of very many cultivators of these plants in England and on the Continent. I have also had a considerable number of species growing under my own observation in a young state. The information derived from these living specimens, and from frequent visits of inspection to Kew and various private gardens and nurseries, has been supplemented and controlled by the examination of the specimens in the herbaria and museums at Kew and at the British Museum. These materials served as the basis of my paper on the Comparative Morphology, &c., of the Order in the "Journal of the Linnean Society," vol. xxvii. (1889), to which the reader is referred for details as to the salient points in the external conformation of these plants.

The rich collections forwarded to the Conifer Congress at Chiswick from all parts of the kingdom also furnished an admirable means of knowing what was really in the country, and of appreciating the confusion in the nomenclature. These specimens were systematically gone through by myself, and, with the exception of those from the Royal Gardens, Kew, which had frequently been studied before *in situ*, scarcely a specimen was left unexamined, at least cursorily. I would fain hope, therefore, that the proportion of errors, whether of commission or of omission, is not larger than is inevitable in a work of this character, involving so much detail, and drawn up amid frequent interruptions and the constant pressure of other duties.

NOMENCLATURE.

As regards general nomenclature, I have followed the principle acted on by Bentham and Hooker in their standard

work, the earlier portions of which were published prior to the publication of the "Lois de la Nomenclature" of 1867. Those botanists personally and critically examined all the genera of flowering plants and the literature connected with them. Their judgment and experience are unsurpassed, so that it is only when errors can be shown, and when modifications, arising from more recent and more complete information, are necessitated, that the student is justified in departing from their standard.

An additional reason for following the general plan of Bentham and Hooker may be found in the publication of the "Index Kewensis," the first sheet of which is passing through the press as these lines are being written. This Index, compiled by Mr. B. Daydon Jackson, with the assistance of Sir Joseph Hooker, purports to be a list of all the generic and specific names of flowering plants published between 1735 and 1885. It is obvious that such a list, prepared by such authority, must in practice have far more weight and influence than any abstract code of laws. Under the circumstances it has, unfortunately, not been possible to take advantage in all cases of this colossal list, for, except as to the first sheet, it is still (February 1892) in manuscript. If it should be found that there are discrepancies between this present list and the Kew Index, it must be borne in mind that the Kew Index is a catalogue of names only, and is not compiled with the same objects or in the same manner as a monograph, where the value of each name has to be ascertained, and, furthermore, that it does not bring the nomenclature, or its revision, to a later date than 1885.

In compiling a list mainly for the use of cultivators, the preponderance of authority, common usage, and general convenience have, in some cases, been assigned more weight than has been given to inelastic rules. "Priority" has generally been respected, but when associated with inaccurate or inadequate publication, or when rigid adherence to it would be more likely to induce confusion than to facilitate research, to check rather than advance knowledge, then it has been disregarded, or treated as obsolete. A name is a mere label, in itself of no intrinsic consequence. In selecting a name, therefore, that which is most generally used and most generally convenient (provided it be not absolutely incorrect or misleading) should, particularly for garden use, be retained. To mix up with the name of a plant matters relating

to its history, synonymy, bibliography, or even to its characterisation, is to prepare the way for endless variety of practice, ceaseless confusion of application, and unlimited difference of opinion.

It is more than questionable whether anyone but a monographer, or one who has studied the plant or plants in question and the literature relating to them, should have the privilege of changing old-established names, simply on the ground that they are not in conformity with legislation, however excellent, of more modern date than themselves. In any case it would be better that he should not lightly exercise the power.

Cultivators are more guided by custom than by law, and such names as *Thuja Lobbii* and *Abies Douglasii*, though open to objection from a strictly botanical point of view, are likely to remain in common use. Fortunately, the vernacular names, which are usually so very objectionable, are in some cases well suited for use, at least by English-speaking growers. Thus, whilst the botanists are making up their minds which out of the host of synonyms they shall adopt as the most appropriate, the gardener may continue to speak of the common Spruce, the common Silver Fir, the Douglas Fir, or the Lawson Cypress without fear of being misunderstood. Such cases are not common; whilst the evils of so-called popular names are, in general, so serious that their adoption, except in a few well-marked instances, such as those just mentioned, is most undesirable even in this country. They are, of course, mostly useless so far as any other country is concerned.*

SYNOPSIS OF TRIBES AND GENERA.

In the following list the genera are first of all mentioned under their appropriate places in the Natural system. Subsequently the genera are arranged in alphabetical order, as being the most generally convenient. Within each genus the

* As this sheet is passing through the press, a pamphlet has been received from Mr. Lemmon, entitled "Approved English Names of the Cone-bearing Trees of the Pacific Slope." In this Mr. Lemmon has coined a number of names, some likely enough to become current, such as the Torrey Pine, the Engelmann Spruce, &c.; but what English cultivator is ever likely to speak of the "Arizona Five-leaved Lumber Pine," or the "Chihuahua Top Cone Pine," or the "Canada Horn Pine"? Surely it is easier to say, *Pinus Arizonica*, *Pinus Banksiana*, or even *Pinus Chihuahua*.

species are also arranged in alphabetical sequence. In the case of the tribes and genera the most striking distinguishing characters are given. Synonyms are indicated by italics. Accepted names, whether of genera or species, are printed in black-faced type. Names applying to varieties are cited in small capitals. Catalogue-names, or names applied to plants shown at exhibitions, but in either case without adequate description or figure, are here passed over, as well as some others not known to be in cultivation in the open air. Some of these omitted names will be found in the "Index Bibliographique" of Morren and Devos (1887).

NAT. ORDER CONIFERÆ.

Mostly evergreen, resin-bearing trees; leaves variable according to stage of growth and position, rarely uniform throughout; male and female flowers separate, either on the same tree (monœcious), or on different trees (diœcious); stamens in catkin-like masses; female flowers in cones, each flower consisting of two scales, one above another, the lower sterile one is the bract, the upper is the seed-scale, on the upper or inner surface of which are placed the seeds. The relative proportions of the bract and of the seed-scale vary in different cases, so that while in some genera a bract and scale are always distinguishable in the ripe cone, in others the two are so intimately blended as to be indistinguishable to the naked eye when the cones are ripe. The male catkin may be either taken as one flower of many stamens; or each stamen may be considered to be a separate flower. Similarly the female cone may be regarded as a single flower of many bracts and scales, or each bract with its seed-scale may be treated as a distinct flower. The seeds are not, as is the case in ordinary flowering plants, enclosed *within* the fruit-scale, or in any cavity like an ovary, but simply lie *upon* its upper surface, whence the name "Gymnosperms," or naked-seeded plants.

These points of structure, though of the highest botanical interest, are, unlike those relating to the life-history and mode of growth, of little importance culturally, and are therefore only incidentally mentioned here. The mode of germination is worthy of notice by the cultivator as well as by the botanist. Some of the details here given are taken from Dr. v. Tubeuf's book, "Samen, Früchte und Keimlinge," etc., Berlin, 1891. These

subjects are discussed at length in my "Review of some Points in the Comparative Morphology, Anatomy, and Life-history of the Coniferæ" in the "Journal of the Linnean Society," vol. xxvii. (1889).

The Order Coniferæ admits of subdivision into tribes, subtribes, and genera as follows:—

I.—THE CYPRESS TRIBE (CUPRESSINEÆ).

Trees or shrubs usually with the adult leaves appressed, opposite, whorled, in 3-4 rows, small, scale-like, rarely linear. Buds not scaly. Flowers usually monœcious. Cones globular or oblong. Scales mostly confluent with the bracts, decussate, generally woody when ripe, but leathery in subgenus *CHAMÆCYPARIS* of *CUPRESSUS*, and fleshy in *Junipers*. Seeds erect.

Subtribe 1. *Juniperinæ*.—Flowers monœcious or dioecious. Cone-scales fleshy, at length confluent. Seeds not winged.

JUNIPERUS.

Subtribe 2. *Callitrinæ*.—Cone-scales verticillate, dry, valvate. Seeds usually winged.

CALLITRIS.

WIDDINGTONIA.

TETRACLINIS.

ACTINOSTROBUS.

Subtribe 3. *Thuinæ*.—Flowers monœcious. Cone-scales dry, decussate or subspirally arranged, oblong or peltate. Seeds winged except in subgenus *BIOTA* of *THUYA*.

FITZROYA.

THUYA.

CUPRESSUS.

LIBOCEDRUS.

II.—THE TAXODIUM TRIBE (TAXODIÆ).

Trees with narrow linear leaves spirally arranged, sometimes apparently two-ranked, not whorled. Buds not scaly. Flowers monœcious. Cones globular or oblong; scales spirally arranged, more or less woody. Bracts partially consolidated with the scales. Seeds 2-6 to each scale, erect or inverted, winged.

CRYPTOMERIA.

SEQUOIA.

TAXODIUM.

ATHROTAXIS.

GLYPTOSTROBUS.

SCIADOPITYS.

III.—THE FIR TRIBE (ABIETINÆ).

Trees with adult leaves linear, arranged spirally, but apparently in two or more rows, or in tufts. Buds scaly. Flowers monœcious. Cones mostly woody; scales arranged spirally, manifestly double—i.e. the bracts, though relatively small, remain separate from the seed-

scales, and are not consolidated with them except at the very base. Seeds 2 to each scale, inverted, winged.

PINUS.	TSUGA.	ABIES.
CEDRUS.	PSEUDOLARIX.	KETELEERIA.
PICEA.	PSEUDOTSUGA.	LARIX.

IV.—THE ARAUCARIA TRIBE (ARAUCARIEÆ).

Trees with spirally arranged, narrow or broad leaves. Buds not scaly. Flowers dioecious or monoecious. Anther-cells pendulous. Cones globular; scales very numerous, spirally arranged, apparently single by the consolidation of bract and scale, the latter being relatively small. Seeds 1-6 to each scale, inverted, winged or wingless.

CUNNINGHAMIA. AGATHIS (*Dammara*). ARAUCARIA.

NAT. ORDER TAXACEÆ.

Evergreen trees (except Ginkgo) or shrubs usually with dioecious flowers; males in catkins; females solitary or loosely arranged at the ends of the branches. Seed-coat either dry or eventually fleshy, partially or completely surrounded by a fleshy, cup-like aril, or by a succulent bract, or borne upon a fleshy stalk.

The order may be divided into tribes and genera as follows :—

I.—THE SALISBURIA TRIBE (SALISBURIEÆ).

Seed erect, its outer coat becoming fleshy, with no aril or with only an imperfectly developed aril at the base.

GINKGO. CEPHALOTAXUS. TORREYA.

II.—THE YEW TRIBE (TAXEÆ).

Seed erect, rarely partly inverted (*Dacrydium*), solitary, outer coat dry, surrounded by a fleshy well-developed aril.

TAXUS. PHYLLOCLADUS. PHEROSPHERA.* DACRYDIUM.

III.—THE PODOCARPUS TRIBE (PODOCARPEÆ).

Seed inverted, outer coat dry, surrounded by a fleshy cup-like aril or supported by a fleshy bract and pedicel.

MICROCACHRYS. PODOCARPUS. PRUMNOPITYS. SAXEGOTHEA.

ALPHABETICAL LIST OF GENERA AND SPECIES.

ABIES, Linn. ; Link ; Bentham and Hooker, *Genera Plantarum*, iii. 411 ; Eichler, p. 70, with figures (not of Don or Loudon). The Silver Firs. (Tribe ABIETINEÆ.)

Trees with whorled branches ; adult leaves 2-ranked, sessile,

* Not in cultivation.

narrow, flat, leaving a circular scar on the branch when they fall. Male catkins scattered, axillary; anthers crested, opening crosswise; pollen-cells winged. Cones erect, maturing the first year. Bracts more or less conspicuous, free from the scales except at their base. Seed-scales becoming detached from a central column when ripe, and each falling separately. Seed with a large inseparable wing. Testa with resin canals. Cotyledons 4-8, flat, leafy, entire. Primary leaves of the same form but much smaller.

The species enumerated under this genus have been, and still are, included in some catalogues, under other genera, as *Tsuga*, *Pseudotsuga*, *Keteleeria* and especially under *Picea* and *Pinus*. The reader who may not find the specific name he seeks under *Abies* should consult the genera named.

A. ajanensis. See *Picea ajanensis*.

A. alba. See *Picea alba* and *P. pectinata*.

A. Albertiana, Murray. See *Tsuga Mertensiana*.

A. Alcockiana. See *Picea Alcockiana*.

1. *A. amabilis*, Forbes, *Pinetum Woburn*. t. 44; Engelmann in *Gard. Chron.* 1880, 720, 725, f. 136-141; Veitch, 86, fig.; Sargent, *Census Report*, 213; Beissner, 468, fig.; Macoun, 475; Masters, *Journ. Linn. Soc.* xxii. (1886) p. 171, fig.; *Gard. Chron.* June 16, 1888, p. 755, fig. male fl. Red Fir.

SYNONYMS:—*Pinus amabilis*, Douglas; Parlature, 426, partly (see also *A. lasiocarpa*). *Pinus grandis*, Lambert, ed. i. t. 26 (not of Douglas). *Picea amabilis*, Loudon, *Arboretum*, f. 2247; *Encycl.* 1046, f. 1960. *Abies grandis*, Murray (not of others). *A. grandis* var. *densiflora*, Engelmann. *A. magnifica* of some gardens, not of Murray.

Fraser River Valley to Oregon. Discovered and introduced by Douglas.

A. Apollinis. See *Abies cephalonica*.

A. arctica, Murray. See *Picea alba*.

2. *A. balsamea*, Miller; Forbes, *Pinetum Woburn*. t. 37; Veitch, 86; Beissner, 464; Macoun, 473. The Balsam Fir.

SYNONYMS:—*Pinus balsamea*, Linnæus; Lambert, ed. i. 48, t. 31; Parlature, 423; Bentley and Trimen, *Med. Plants*, iv. tab. 263. *Picea balsamea*, Loudon, *Arboretum*, f. 2240; *Encycl. Trees*, 1044, f. 1953.

VARIETIES:—HUDSONICA, Veitch, 88; Beissner, 465; also vars. LONGIFOLIA, BRACHYLEPIS, CERULEA, NANA, PROSTRATA, DENUDATA, NUDICAULIS, VARIEGATA and ARGENTEA of catalogues.

Canada and North-east United States.

A. bifida. See *Abies firma*.

A. bifolia, Murray. See *Abies lasiocarpa*.

3. *A. brachyphylla*, Maximowicz. Masters in *Gard. Chron.* Nov. 1, 1879, p. 556, fig. 92, and in *Journ. Linn. Soc.* vol. xviii. p. 515.

For full synonymy, see also *Gard. Chron.* August 1, 1885, p. 151, fig. 30; Veitch, 89, fig.; Beissner, 453.

Japan. Discovered on Fusi Yama by Maximowicz.

4. *A. bracteata*, Nuttall; Hook. in *Bot. Mag.* t. 4740; Engelmann in *Gard. Chron.* 1879, 684; Veitch, 89, f. 14, 15; Masters in *Gard. Chron.* Feb. 23, 1889, p. 242, f. 44, and May 31, 1890, 672, fig. 112, male flowers; Beissner, 489, fig. Bristle Cone Fir of Lemmon.

SYNONYMS:—*Pinus venusta*, Douglas, MSS. *P. bracteata*, Don; Lambert, ed. i. t. 91; Hook. *Icon.* 379; Parlature, 419. *Picea bracteata*, Loudon, *Arboretum*, iv. f. 2256; *Encycl. Trees*, 1049, fig. 1964; *Pinet. Brit.* ii. 171, t. 25, 26; Coleman in *Garden*, 1889, Jan. 5, fig.; Lemmon, *Third Report*, No. 17. *Abies venusta*, Sargent; Koch, *Dendrol.* ii. 210.

Introduced by Douglas from the Santa Lucia Mountains, California.

A. Bridgesii, ex *Kew Index* = *Tsuga Mertensiana*.

A. Brunoniana. See *Tsuga Brunoniana*.

A. cærulea. See *Picea alba*.

A. cærulescens. See *Picea rubra*.

A. californica, ex *Kew Index* = *Pseudotsuga Douglasii*.

A. campylocarpa, ex *Kew Index* = *Abies magnifica*.

A. canadensis. See *Tsuga canadensis*.

A. candicans. See *A. pectinata*.

A. Cedrus. See *Cedrus Libani*.

5. *A. cephalonica*, Loudon; Masters in *Gard. Chron.* Nov. 8, 1884, 592, fig. 105; Veitch, 92; Beissner, 438; *Gard. Mag.* Nov. 24, 1888.

SYNONYMS:—*A. Apollinis*, Link; Boissier, v. 702; *Pinet. Brit.* ii. 167, t. 24. *A. panachaica*, Heldreich. *A. reginæ Amaliæ*, Heldreich. *Gard. Chron.* August 17, 1861, p. 755. *Pinus Abies*, var. *cephalonica*, Parlature, 422. *Picea cephalonica*, Loudon, *Encycl.* 1039, f. 1940; *Pinet. Brit.* ii. 175, t. 27.

VARIETIES:—Carrière describes a var. *RUBIGINOSA*, and Bailly one under the name *SUBMUTICA*. A hybrid is also mentioned between *CEPHALONICA* and *PINSAPU*, *Revue Horticole*, 1889, p. 115.

Mountains of Greece. Probably a variety of the Silver Fir (*A. pectinata*), but distinct enough for cultural purposes to be considered as a species.

6. *A. cilicica*, Carrière, *Conifères*, 229; Veitch, 110; Beissner, 448; Boissier, *Flor. Orient.* v. 703.

SYNONYM:—*Pinus cilicica*, Parlature.

Discovered by Kotschy in the mountains of the Cilician Taurus; alt. 4,000-7,000 feet.

A. chlorocarpa, ex *Kew Index* = *Picea excelsa*.

A. cinerea, ex *Kew Index* = *Picea excelsa*.

A. Clanbrassiliana, a form of *Picea excelsa*.

A. commutata. See *Picea Engelmanni* and *P. pungens*.

7. *A. concolor*, Lindley and Gordon, *Journ. Hort. Soc.* 1850, v. 210 ; Engelmann in *Gard. Chron.* 1879, 684, f. 114, 115 ; Masters in *Gard. Chron.* 1879, 684, f. 114 ; Dec. 27, 1890, p. 749, cones ; and in *Journ. Linn. Soc.* xxii. 177, partly ; Beissner, 470, partly, fig. 130, but excl. syns. ; Veitch, 93. Colorado White Fir.

SYNONYMS:—*Pinus concolor*, Parlature, 426. *Picea concolor*, Murray in *Gard. Chron.* 1875, p. 135, f. 26. *Picea lasiocarpa* of some gardens (not of Hooker). See also *A. Lowiana*.

VARIETY:—*VIOLACEA* = *Picea concolor* var. *VIOLACEA*, Roetz ; Murray in *Gard. Chron.* 1875, 464, f. 94. Engelmann in *Gard. Chron.* 1879, Nov. 29, p. 684, and Masters in *eodem* Dec. 27, 1890, p. 751. *Abies concolor violacea*, *Gard. Chron.* 189, fig. 751.

Colorado, Utah, Arizona.

A. currifolia, ex *Kew Index* = *Picea alba*.

A. Davidiana, Franchet. See *Keteleeria Davidiana*.

A. decidua, ex *Kew Index*. See *Tsuga Brunoniana*.

A. denticulata, Poirer. See *Picea nigra*.

A. Douglasii. See *Pseudotsuga Douglasii*.

A. dumosa, Loudon. See *Tsuga Brunoniana*.

A. Eichlerii, Lauche in *Gart. Zeit.* Feb. 1882, c. ic. = *A. Veitchii*.

A. elegans, Knight. See *Picea excelsa*, fide *Kew Index*.

A. excelsa. See *A. pectinata* and *Picea excelsa*.

A. finedonensis. See *Picea excelsa*.

8. *A. firma*, Siebold and Zuccarini, *Flor. Jap.* ii. 15, t. 107 ; Masters in *Gard. Chron.* 1879, p. 198, and in *Journ. Linn. Soc.* xviii. p. 514 ; Veitch, 95 ; Beissner, 451, fig. ; Mayr, *Mon. Abiet. Japan.* 31, c. tab. ; *Journ. of Hort.* Oct. 8, 1891.

SYNONYMS:—*Pinus firma*, Antoine ; Parlature, 424. *Abies holophylla*, Maximowicz.

ABIES BIFIDA, Siebold and Zuccarini, is a name applying to the young sterile stage in which the leaves are of a different form from those on the older and on the cone-bearing branches.

Introduced by Siebold from Japan.

A. Fortunei. See *Keteleeria Fortunei*.

9. *A. Fraseri*, Lindley ; Veitch, 96 ; Beissner, 463 ; Sargent in *Garden and Forest*, Oct. 2, 1889 ; Masters in *Gard. Chron.* Dec. 13, 1890, p. 684, fig. 132.

SYNONYMS:—*Picea Fraseri*, Loudon, *Arboret.* fig. 2243 ; *Encycl.* 1045, f. 1965. *Pinus Fraseri*, Parlature, l.c. 420 ; Lambert, ed. iii. t. 29.

Mountains of Carolina and Pennsylvania. Discovered and introduced by Fraser in 1811.

A. glauca and *A. glaucescens*, Roetz. See *A. religiosa*.

10. *A. grandis*, Lindley; *Pinet. Woburn.* t. 43; Engelmann in *Gard. Chron.* 1879, p. 684; Masters in *Gard. Chron.* 1881, 179, f. 33-36; and in *Journ. Linn. Soc.* xxii. 174, t. 3, figs.; Veitch, 97, f. 23, 24, fig.; Beissner, 477, fig.; *Garden*, Sept. 27, 1890; Macoun, 474. Oregon White Fir of Lemmon.

SYNONYMS.—*Pinus grandis*, Douglas; Parlatore, 427. *Picea grandis*, Loudon, *Arboretum*, iv. f. 2245; *Encycl. Trees*, 1045, f. 1958; Murray in *Gard. Chron.* 1875, 135, f. 28.

Vancouver's Island to California, near the coast; western slopes of Rocky Mountains. Discovered and introduced by Douglas.

A. grandis, Murray. See *Abies amabilis*.

A. Hanburyana. See *Tsuga*.

A. Harryana. See *A. homolepis*.

A. holophylla, Maximowicz; Beissner, 452 = *Abies firma*.

11. *A. homolepis*, Siebold and Zuccarini, *Flor. Jap.* ii. p. 17, t. 108; Masters in *Gard. Chron.* 1879, p. 823. Sometimes referred to *A. firma*, but it differs.

SYNONYMS.—*Pinus Harryana*, MacNab; *Abies Tschonoskiana*. For the full synonymy, see Mayr, *Abiet. Japan.* (1890), 35, t. 2.

Japan.

A. Hookeriana. See *Tsuga*.

A. Hudsonica, Engelmann; Sargent, *Census Report*, 211. Supposed to be an alpine form of *A. balsamea*, Veitch, 83. The resin canals are sub-epidermal, and there is no hypoderm. The cones are unknown.

A. jezoensis. See *Picea Alcockiana* and *Keteleeria Fortunei*.

A. Kaempferii. See *Pseudolarix*.

12. *A. lasiocarpa*, Hooker; Nuttall; Masters in *Gard. Chron.* Feb. 9, 1889, p. 172, figs. 26, 27, 32; *Journal of Botany*, 1889, May; Sargent, *Garden and Forest*, Oct. 16, 1889 (not of gardens).

SYNONYMS.—*A. (Picea) bifolia*, Murray in *Gard. Chron.* 1875, 465, figs. 96, 97. *A. subalpina*, Engelmann; Veitch, 111; Masters in *Gard. Chron.* 1880, 235, figs. 43-45, and in *Journ. Linn. Soc.* xxii. 183, fig.; Beissner, 467; Macoun, 474. *A. subalpina* var. *fallax*, Engelmann.

VARIETY :—*CERULESCENS*.

Alaska, British Columbia. Oregon to Colorado, 4,000-12,000 feet. Discovered by Douglas.

A. lasiocarpa of gardens. See *Abies Lowiana*.

A. laxa, Koch, *Dendrol.* ii. 253. See *Picea alba*.

13. *A. Lowiana*, Murray in *Proc. Hort. Soc. London*, iii. 317, fig. 38, 41 (?); Masters in *Gard. Chron.* Dec. 11, 1886, p. 755, f. 148. *Gard. Chron.* 1890, Dec. 27, p. 750, fig.; California White Fir of Lemmon.

SYNONYMS:—*A. grandis* var. *Lowiana*, Masters in *Journ. Linn. Soc.* xxii. 175, figs.; Lemmon, *Third Report*, 15, 16. *Picea Lowiana*, Gordon, *Pinet.* ed. 2, 218. *Abies lasiocarpa* of some gardens, and *Garden*, March 2, 1889. *A. Parsonsiana*, of some gardens. *A. concolor*, Veitch, 93; *Gard. Chron.* May 22, 1880, p. 648. *A. concolor*, var. *lasiocarpa*, Beissner, 473.

Western slope of the Sierra Nevadas, North California, Oregon.

A. Luscombeana, Loudon = *Abies cephalonica*.

14. *A. magnifica*, Murray in *Proc. Roy. Hort. Soc.* iii. 1863, 318, and in *Gard. Chron.* 1875, 134; Engelmann in *Gard. Chron.* Nov. 29, 1879, 685, f. 116; Masters in *Gard. Chron.* Nov. 21, 1885, p. 661, f. 148; Sargent, *Tenth Census Report*, 214; Veitch, 99; Beissner, 483; Lemmon, *Third Report*, t. 13.

SYNONYMS:—*A. campylocarpa*, Murray, ex *Index Kewensis*. *Picea magnifica*, Gordon. Murray in *Gard. Chron.* June 12, 1875, p. 753, fig. Syme in *Gard. Chron.* March 16, 1878, p. 343, fig.

VARIETIES:—*XANTHOCARPA*, Lemmon, *Third Report*, 14; *SHASTENSIS*, Lemmon = *A. nobilis* var., Masters in *Gard. Chron.* Nov. 11, 1885, fig. 147; Oct. 10, 1891, p. 428; and in *Journ. Linn. Soc.* xxii. tab. 5. California Red Fir.

North California. Introduced by Jeffrey in 1851. By some considered as a form of *A. nobilis*.

A. Mariana. See *Picea nigra*.

15. *A. Mariesii*, Masters in *Gard. Chron.* Dec. 20, 1879, p. 788, c. ic.; and *Journ. Linn. Soc.* xviii. 519 c. ic.; Veitch, 100; Beissner, 455, fig.; Mayr, *Abiet. Jap.* 40, t. 2.

Mountains of Japan. Discovered and introduced by Maries.

A. Maximowiczii. See *Picea Maximowiczii*.

A. Menziesii. See *Picea sitchensis*.

A. medioxima. See *Picea excelsa*.

A. Momi. See *Abies firma*.

A. nephrolepis. See *A. Veitchii*.

A. microsperma. See *Picea ajanensis*.

A. Morinda. See *Picea Morinda*.

16. *A. nobilis*, Lindley; Forbes, *Pinet. Woburn.* t. 40; Engelmann in *Gard. Chron.* 1878, 885; Veitch, 101, fig.; Sargent, *Census Report*, 214; Beissner, 485; Masters in *Journ. Linn. Soc.* xxii. 189, and in *Gard. Chron.* Nov. 21, 1885, p. 653.

SYNONYMS:—*Pinus nobilis*, Douglas MSS.; Lambert, ed. i. t. 74. *Picea nobilis*, Loudon, *Arboretum*, f. 2249; *Encycl. Trees*, 1046, f. 1962; *Pinetum Britan.* iii. 181, t. 28. Syme in *Gard. Chron.* March 16, 1878, p. 343.

VARIETIES:—*A. nobilis magnifica*, Masters in *Journ. Linn. Soc.* xxii. 189; *Gard. Chron.* Nov. 21, 1885, p. 652, fig. 147. (See *Abies*

magnifica.) *GLAUCA. ROBUSTA*. Under the last name some form of *A. magnifica* is often grown.

Mountains of Oregon and California. Discovered and introduced by Douglas.

17. *A. Nordmanniana*, Spach; J. D. Hooker in *Bot. Mag.* t. 6992; Masters in *Gard. Chron.* Jan. 30, 1886, p. 145, fig.; Oct. 17, 1891, p. 460; Beissner, 435; Veitch, 102; Boissier, *Flor. Orient.* v. 703.

SYNONYM:—*Picea Nordmanniana*, Loudon, *Encycl.* 1042, f. 1950.

VARIETIES:—The varieties *REFRACTA*, *SPECTIOSA*, *GLAUCA*, *ROBUSTA*, *BREVI-FOLIA*, *AUREA*, *AUREO-SPICA* are mentioned by Beissner. *A. INSIGNIS*, Carrière, is said to be a hybrid between *Nordmanniana* × *Pinsapo*.

Crimea, Caucasus. Introduced in 1848. Probably a variety of the Silver Fir, but sufficiently distinct to be kept separate for garden purposes.

18. *A. numidica*, De Lannoy (1866); Veitch, 103; Beissner, 447. See Masters in *Gard. Chron.* Feb. 4, 1888, p. 140, fig. 23, for full synonymy; Trabut, *Rev. Gen. Bot.* August 1889.

SYNONYM:—*A. Pinsapo* var. *baborensis*, Cosson.

Algerian mountains, at 4,000–6,000 feet. Discovered by Gibert in 1861. Introduced to France by De Lannoy.

A. Parryana. See *Picea pungens*.

A. Parsonsiana. See *Abies Lowiana*.

19. *A. pectinata*, De Candolle, *Flor. Franc.* p. 276 (1805); *Kew Index*; Link; Boissier, *Flor. Orient.* v. 701; Veitch, 103; Beissner, 428. The common Silver Fir, known from classical times.

SYNONYMS:—*Abies alba*, Miller (1768); Richter, *Plant. Europ.* *A. vulgaris*, Poiret, *Encycl. Method.* vol. vi. (1804): this and the preceding are the two oldest names, but neither has been generally taken up. *A. Picea*, Lindley. *A. excelsa*, Salisbury (1805); Link (1827). *A. taxifolia*, Desfontaines (1809). *Picea pectinata*, Loudon, *Arboretum*, f. 2237; *Encycl. Trees*, 1037, f. 1939. *Pinus pectinata*, Lamarck (1778). *Pinus Abies*, Duroi (1771); Endlicher. *Pinus Picea*, Linnæus, 1753.

VARIETIES:—*EQUI-TROJANI*, Ascherson ex Beissner, 431; *PYRAMIDALIS*, *STRICTA*, *FASTIGIATA*, *COLUMNARIS*, *PENDULA*, *VIRGATA*, *TORTUOSA*, *BREVI-FOLIA*, *TENUIORIFOLIA*, *VARIEGATA*, *AUREA*, ETC.

The following additional names belonging to this species are taken, by permission, from the *Kew Index* (unpublished), but the names are not in common use: *A. argentea*, *baldensis*, *candicans*, *metensis*, *minor*.

This is one of the cases where adhesion to strict priority would lead to endless confusion, and hence I have adopted the name most generally adopted.

Mountains of Central and Southern Europe.

A. Pattoniana. See *Tsuga*.

A. Pichta. See *Abies sibirica*.

A. Pindrow, Spach; Masters in *Gard. Chron.* 1886, p. 691, fig. 154; Veitch, 110. See *Abies Webbiana*.

20. *A. Pinsapo*, Boissier; Masters in *Gard. Chron.* October 10, 1885, p. 468, fig. 99; single cone, July 3, 1886, fig. 1; (male flowers), Feb. 4, 1888, p. 140 leaf-section. Veitch, 105; Beissner, 445.

SYNONYM:—*Picea Pinsapo*, Loudon, *Encycl.* 1041, f. 1948; *Pinet. Brit.* ii. 189, t. 30.

VARIETIES:—*HAMONDII*, Veitch, 105; *GLAUCA*. M. E. Bailiff, in *Revue Horticole*, March 1, 1889, p. 115, describes a hybrid, raised by M. H. de Vilmorin, between *A. Pinsapo* and *A. cephalonica*.

Mountains of Southern Spain, 3,000–6,000 feet. Discovered in the Spanish Sierras and introduced by Boissier.

A. reginæ Amaliae. See *A. cephalonica*.

21. *A. religiosa*, Schlechtendal; Masters in *Gard. Chron.* Jan. 10, 1885, fig. 13, March 7, 1891, p. 305, 307, and in *Journ. Linn. Soc.* xxii. 195; Veitch, 111; Beissner, 491.

SYNONYMS:—*Picea religiosa*, A. Murray in *Gard. Chron.* April 29, 1876, p. 561, fig.; Loudon, *Encycl. Trees*, 1049, f. 1965. *A. hirtella*, Lindley.

Mountains of Mexico and Guatemala, 4,000 feet. Discovered by Humboldt. Introduced by Hartweg in 1838.

22. *A. sachalinensis*, Masters in *Gard. Chron.* Nov. 8, 1879, p. 588, fig. 97, and *Journ. Linn. Soc.* xviii.; Veitch, 106, fig.; Mayr, *Mon. Abiet. Japan* (1890), p. 42, t. 3, f. 6.

SYNONYM:—*A. Veitchii* var. *sachalinensis*, Schmidt; Beissner, 461, fig. ex *Gard. Chron.* l.c.

Sachalin, Jesso. Introduced from Jesso by Maries for Messrs. Veitch.

A. sacra. See *Keteleeria sacra*.

23. *A. sibirica*, Ledebour; Beissner, 455; Veitch, 111.

SYNONYMS:—*A. Pichta*, Forbes, *Pinetum Woburn.* t. 37. *Picea Pichta*, Loudon, *Arboretum*, iv. f. 2338; *Encycl.* 1043, f. 1951.

Northern and Eastern Russia.

A. sitchensis. See *Picea Menziesii*.

A. Smithiana. See *Picea Morinda*.

A. spectabilis, Don. See *Abies Webbiana*.

A. subalpina, Engelmann. See *Abies lasiocarpa*.

A. taxifolia. See *Pseudotsuga Douglasii*. The same name has also been applied to *Tsuga Mertensiana*, and to *Abies pectinata*.

A. torano. See *Picea polita*.

24. *A. umbellata*, Mayr, *Mon. Abiet. Japan*, 1890, p. 34, t. 1. (Only known from Mayr's description and figure.)

25. *A. Veitchii*, Lindley in *Gard. Chron.* 1861, 23; Carrière; Masters in *Gard. Chron.* 1880, 275, f. 50, and March 1, 1890; Veitch, 107, fig.; Beissner, 451; Mayr, *Mon. Abiet. Japan* (1890), 38, f. 4.

SYNONYMS:—*Picea Veitchii*. *Pinus selenolepis*, Parlatores, 427. *Abies nephrolepis*, Maximowicz; Beissner, 457. *A. Eichleri*, Lauche.

Mountains of Japan, alt. 6,000–7,000 feet. Discovered and introduced by Mr. J. G. Veitch.

A. venusta, Koch, *Dendrol.* ii. 210 = *A. bracteata*.

26. *A. Webbiana*, Lindley; Boissier, *Flor. Orient.* v. 703; Veitch, 109; Beissner, 479, fig.; Masters in *Gard. Chron.* Oct. 11, 1884, p. 467, fig. 86, Oct. 3, 1891, p. 395; J. D. Hooker in *Gard. Chron.* June 19, 1886, fig. 175, &c.

SYNONYMS:—*Picea Webbiana*, Loudon, *Encycl. Trees*, 1051, f. 1969. *A. chiloensis* and *A. chilowensis* are cited as garden synonyms.

VARIETY:—PINDROW, Brandis ex Hooker in *Flor. Brit. India*; Beissner, 481. *Pinus Pindrow*, Royle, *Ill.* t. 86. *Picea Pindrow*, Loudon, *Arbor.* iv. f. 2254; *Encycl.* 1052, f. 1970.

Eastern Himalayas, 9,000–13,000 feet.

A. Williamsoni. See *Tsuga Mertensiana* and *T. Pattoniana*.

ACTINOSTROBUS, Miquel; Benth. et Hook. iii. 425; Parlatores, 445. (Tribe CUPRESSINÆ; Sub-tribe CALLITRINÆ.)

Trees with 3-ranked, scale-like foliage; male flowers spiked, anthers peltate, 4-lobed; cone-scales six, equal, verticillate around a central axis, each with one or two, winged seeds.

1. *A. pyramidalis*, Miquel.

West Australia. Conservatories.

AGATHIS, Salisbury (1805); Benth. et Hooker, *Genera Plantarum*, iii. 436; Eichler, *Natur. Pflanz.* (1889) 66, fig.

DAMMARA, Lambert; Parlatores in *DC. Prod.* xvi. 2, 374. (Tribe ARAUCARIÆ.)

Trees with monœcious or diœcious flowers, males in catkins. Anther-lobes 5 or more. Pollen-cells globose, not winged. Cones globular, the scales separating when ripe. The scale and the bract are so united as to form apparently a single organ. Seed 1 to each scale, obliquely winged, pendulous. Cotyledons 2, leafy. Several species are figured in Kirk's *Forest Flora of New Zealand*.

1. *A. australis*, Salisbury in *Linn. Trans.* viii. 312.

SYNONYM:—*Dammara australis*, Lambert, *Pinetum*, 2, p. 73, t. 44; Parlatores, l.c. 376; *Gard. Chron.* October 27, 1883, fig. 86.

The Kauri Pine of New Zealand, most important for its timber and for the so-called gum which exudes from the trunk. See Kirk's *Forest Flora of New Zealand*, p. 144, tabs. 79-81.

Cultivated in conservatories.

2. *A. macrophylla*.

SYNONYM:—*Dammara macrophylla*, Lindley in *Journ. Hort. Soc.* vi. p. 271; Parlature, 376.

South Sea Islands. Conservatories.

3. *A. Moorei*.

SYNONYM:—*Dammara Moorei*, Lindley in *Journ. Hort. Soc.* vi. 271; Parlature, 377.

New Caledonia. Conservatories.

4. *A. obtusa*.

SYNONYM:—*Dammara obtusa*, Lindley in *Journ. Hort. Soc.* vi. p. 270, and in Paxton, *Flower Garden*, ii. 146; Parlature, 376.

New Hebrides. Conservatories.

5. *A. robusta*.

SYNONYM:—*Dammara robusta*, C. Moore, ex Parlature, l. c. 375.

North-east Australia. Conservatories.

ARAUCARIA, Jussieu (1789); Bentham and Hooker, iii. 437; Parlature in *DC. Prod.* xvi. 2; Eichler, *Pflanzenfamilien*, ii. 67.

ALTINGIA, Loudon partly; EUTASSA, Salisbury partly. (Tribe ARAUCARIEÆ.)

Lofty trees. Flowers dioecious; males in spikes; anther-lobes 8-15, pendulous; pollen globose. Cones globular, scales very numerous, spiral, deciduous, united with the bracts. Ovule 1 to each scale, more or less winged, inverted, and more or less united with the scale itself. Cotyledons epi- or hypogeal.

A. araucana, Koch, *Dendrol.* ii. 206 = *A. imbricata*.

1. *A. Balansæ*, Brongn. et Gris.; André in *Illust. Horticole*, 1875, t. 197.

New Caledonia. Conservatories.

2. *A. Bidwillii*, Hooker; *Gard. Chron.* 1873, 361, fig. 73; Veitch, 195. Benth. *Flor. Aust.* vi. 243. The Bunya Bunya.

Mountains of Queensland. Height 100-150 feet. Succeeds under conservatory treatment.

3. *A. brasiliana*, A. Richard; Veitch, 195; *Gard. Chron.* June 23, 1888. Sometimes written *Brasiliensis*.

VARIETY :—SAVIANA, Parlature, 371.

Mountains of S. Brazil. Height 75-100 feet.

Suitable for conservatories.

A. chilensis. See *A. imbricata*.

A. columnaris. See *A. Cookii*.

4. *A. Cookii*, R. Brown ; Veitch, 196 ; Lindley in *Journ. Hort. Soc.* vi. p. 267, c. ic. ; Abbey in *Gard. Chron.* June 23, 1888, p. 774 et seq. c. ic.

SYNONYM:—*A. columnaris*, Hook. ; *Bot. Mag.* t. 4635.

New Caledonia. Height 150–200 feet. Conservatory.

5. *A. Cunninghamii*, Aiton (1827) ; Veitch, 196 ; Parlatore, 372 ; Loudon, *Arboretum*, 2443, figs. ; Lambert, t. 96. Benth. *Flor. Aust.* vi. 243. The Moreton Bay Pine.

VARIETY:—GLAUCA, *Gard. Chron.* June 2, 1888, p. 685, f. 90.

Mountains of Queensland and *fide* Mueller of New Guinea ! Height 100–125 feet. Conservatory.

A. elegans. See *A. brasiliana*.

6. *A. excelsa*, R. Brown (1813) ; Parlatore, 373 ; Loudon, *Arboretum*, 4, 2440, figs. ; Forbes, *Pinet. Woburn.* t. 50 ; Veitch, 196 ; *Gard. Chron.* May 26, 1888, p. 649 ; F. v. Mueller, *Fragmenta*, ix. 169. The Norfolk Island Pine.

VARIETY:—ALBO-SPICA.

Norfolk Island. Height 150–200 feet. Conservatory.

A. Goldieana, hort. ; *Florist* (1887), 39. See *A. Rulei*.

A. gracilis. See *A. brasiliana*.

7. *A. imbricata*, Pavon ; Lambert, ed. 2, t. 45 ; *Pinet. Woburn.* t. 35, 36 ; Loudon, *Arboretum*, 2286 ; *Encycl.* 1063, figs. ; *Pinet. Brit.* i. 99, t. 14, 15 ; Masters in *Gard. Chron.* 1873, 291 ; 688, 1889 ; and Nov. 22, 1890 ; Veitch, 191, figs. ; Beissner, 200, with figs. The Dropmore tree, *Gard. Chron.* October 5, 1872, p. 1324 ; germination of, 1890, Nov. 22, p. 592 ; monœcious, Nov. 22, 1890, p. 592, fig.

Mountains of Southern Chili. Height 100–150 feet. Introduced by Menzies in 1796. One of the trees introduced by him is still in the Royal Gardens, Kew.

A. Lindleyana = *A. brasiliana*.

A. Ridolfiana. See *A. brasiliana*, ex *Kew Index*.

8. *A. Rulei*, Ferd. v. Mueller ; Veitch, 197 ; *Gard. Chron.* Sept. 28, 1861, p. 868, c. ic.

VARIETY:—GOLDIEANA.

New Caledonia. Height 40–50 feet. Conservatory. Introduced by Messrs. Veitch in 1863.

A. Van Geertii, *Gard. Chron.* 1876, v. 603.

Arbor-Vitæ. See *Thuya*.

ATHROTAXIS, Don (1839) ; Bentham and Hooker, iii. 430 ; Parlatore, p. 433 ; Eichler, 85. (Tribe TAXODIÆ.) Sometimes, but erroneously, written *Arthrotaxis*.

Tasmanian trees. Leaves evergreen, uniform, spiral. Flowers

monoecious, males in terminal spikes, anther-lobes 2; cones globular, scales spirally arranged, with the tip of the bract projecting beyond the fruit-scale. Seeds 3-6 to each scale, pendulous, free, winged.

1. *A. cupressoides*, Don in *Trans. Linn. Soc.* xviii. 171, t. 13 (1839); Parlatores, p. 433; Veitch, 223; Masters in *Gard. Chron.* August 29, 1885, p. 273, fig. 60, and Dec. 10, 1887, p. 725.

Tasmania.

A. Doniana. See *A. laxifolia*.

2. *A. laxifolia*, Hooker, *Icones*, tab. 573 (1843); Veitch, 223; Masters in *Gard. Chron.* Nov. 7, 1885, p. 584, fig. 134; 1887, Dec. 10, p. 725; 1891, p. 145; and in *Journ. Linn. Soc.* xxii. 201.

SYNONYM:—*Athrotaxis Doniana*, hort.

Tasmania.

3. *A. selaginoides*, Don, l. c. t. 14; Parlatores, p. 434; Veitch, 223; Masters in *Gard. Chron.* Dec. 10, 1887, p. 724; and Nov. 10, 1888, p. 544, fig. 79.

Tasmania.

A. tetragona, Hooker, l. c. t. 560. See *Microcachrys*.

BIOTA. See *Thuya*.

CALLITRIS, Ventenat (1808); Bentham and Hooker, iii. 424; Eichler, 93. **FRENELA**, Mirbel; Parlatores, 445; Benth. *Flor. Aust.* vi. 235; F. von Mueller, Second Census Australian Plants (1889), p. 184. (Tribe CUPRESSINEÆ; Sub-tribe CALLITRINEÆ.)

Australian trees, with brittle twigs and small, 4-ranked, deeply adnate leaves. Male fl. in spikes, anthers crested with 2 or more lobes, pollen globose. Cone-scales 4 to 8, at first touching at the margins, afterwards partially separating, but always united at the base. Seeds 2-9 erect, winged. Cotyledons 2-4, linear.

C. articulata, hort. See *C. rhomboidea*.

C. capensis, Schrader ex Gordon = *Widdringtonia*?

C. macrostachya = *Callitris Gunnii*, Hook. f. not in cultivation (?)

1. *C. rhomboidea*, R. Br. in Richard, *Conif.* p. 47, t. 18. The Oyster Bay Pine of Tasmania.

SYNONYMS:—*C. australis*, Hook. f. in *Lond. Journ. of Botany*, iv. 147. *Frenela rhomboidea*, Endlicher; Parlatores, l. c. 447. *Thuya australis*, Poiret.

C. pyramidalis, Sweet = *C. calcarata* (*Kew Index*).

C. quadrivalvis = *Tetraclinis articulata*.

2. *C. robusta*, R. Br.

SYNONYMS:—*Frenela robusta*, Allan Cunningham; Parlatores, 450. ? *C. triquetra*, Loudon, *Encycl. Trees*, 1072.

CEDAR. See CEDRUS.

Cedar of Bermuda. See *Juniperus Bermudiana*.

Cedar of Goa. See *Cupressus lusitanica*.

Cedar of Japan. See *Cryptomeria japonica*.

Cedar, Pencil. See *Juniperus Bermudiana*.

Cedar, Red. See *Juniperus Virginiana*.

Cedar, White. See *Cupressus Thyoides*.

CEDRUS, Loudon; Bentham and Hooker, *Gen. Plant.* iii. 439; Eichler, *Pflanzenfamil.* ii. 69, fig. **PINUS**, sect. **CEDRUS**, Parlatores in *DC. Prod.* xvi. ii. 407. (Tribe **ABETINEÆ**.)

Trees with long shoots and scattered leaves, or with short "spurs" and tufted leaves, the latter in all cases linear and persistent. Stamens in catkins; anther-lobes 2, crested; pollen-cells winged. Cone-scales over-lapping, ultimately falling, but leaving no central axis. Scales much larger than the bracts. Wing of seed truncate, very large. Seed with resin-canals. Cotyledons leafy, 8-9, entire 3-sided.

C. africana. See *C. atlantica*.

C. argentea. See *C. Libani*.

1. *C. atlantica*, Manetti; Carrière, 285; Veitch, 133; Beissner, 303; *Garden*, Oct. 5, 1889; *Pinet. Brit.* iii. 217, t. 38; *Gard. Chron.* 1891, 425, fig.

SYNONYMS:—*Abies atlantica*, Lindley and Gordon; *Journ. Hort. Soc.* v. 214. *Pinus Cedrus* var. *atlantica*, Parlatores, l.c. 408. *Cedrus africana*, Gordon.

VARIETIES:—Beissner cites the following as varieties: **GLAUCA**, **VARIEGATA**, **PYRAMIDALIS**, **COLUMNARIS**, **FASTIGIATA**.

Algeria.

For garden purposes it is well to keep the Atlas Cedar distinct from the Lebanon and Deodar Cedars; but the two first, and perhaps the third also, are, according to Sir Joseph Hooker, geographical forms of one and the same species. See Hooker in *Nat. Hist. Review*, 1861, ii. t. 1-3.

2. *C. Deodara*, Loudon, *Arboretum*, iv. 2428; *Encycl.* 1060, f. 1975; *Pinetum Britannicum*, iii. 225, t. 39, 43, with figs.; Forbes, *Pinet. Woburn.* tab. 48, 49; Boissier, *Flor. Orient.* v. 699; Masters in *Gard. Chron.* October 10, 1891, p. 423, fig.; Veitch, 134; Beissner, 305. The Deodar.

SYNONYMS:—*Pinus Deodara*, Roxburgh ex Lambert. *Abies Deodara*, Lindley. *Larix Deodara*, Koch. *Cedrus indica*, Chambr. *C. Libani* var. *Deodara*, Hook. *Flor. Brit. Ind.* (1890), v. 653.

VARIETIES:—**ARGENTEA**, **AUREA**, **CRASSIFOLIA**, **ROBUSTA**, **COMPACTA**,

UNCINATA, VERTICILLATA, VARIEGATA, VIRIDIS, HÜGELI, *Gard. Chron.* Feb. 9, 1878, p. 172, fig. 31.

Himalayas. Introduced in 1831. One of the first plants raised in Devonshire by Sir Thomas Acland from seed produced in England is now at Kew.

C. elegans. See *C. Libani*.

C. indica, Chambr. = *C. Deodara*.

3. *C. Libani*, Loudon, *Arboretum*, iv. 2402; *Encycl.* 1057, f. 1974; *Pinetum Britannicum*, vol. iii. 247, t. 44-50; Veitch, 137; Beissner, 297, figs.; Boissier, *Fl. Orient.* v. 699. *Gard. Chron.* Jan. 26, 1878, fig.; Oct. 30, 1886, fig. The Cedar of Lebanon.

SYNONYMS:—*Pinus Cedrus*, Linnæus; Parlatores, l.c. 407. *Larix Cedrus*, Miller. *Abies Cedrus*, Poiret; Lindley. *Larix patula*, Salisbury. *Cedrus patula*, Koch, *Dendrol.* ii. 268.

VARIETIES:—*BREVIFOLIA*, Hook. *Journ. of Bot.* 1880, p. 31; *ARGENTEA* alias *GLAUCA*, *VIRIDIS*, *NANA*, *PYRAMIDATA*, *DENUDATA*, *PENDULA*, *STRICTA*, *DECIDUA*, *HYBRIDA*. See Carrière and Beissner.

Syrian Mountains, Cyprus. See Captain Oliver in *Gard. Chron.* August, 1879, p. 177, with fig., for an account of the Cedar growing in its native localities. Introduced about 1666.

C. patula. See *C. Libani*.

CEPHALOTAXUS, Siebold et Zuccarini; Benth. et Hook. *Gen. Pl.* iii. 430; Parlatores in *DC. Prod.* xvi. 2. 503; Eichler, 108; Van Tieghem, *Bull. Soc. Bot. France*, 1891, April 24. Masters in *Gard. Chron.* Jan. 26, 1884, p. 113, figs. (*TAXACEÆ*, Tribe *SALISBURIEÆ*.) Placed by Benthham in the tribe *Taxodieæ*, but more appropriately ranged near *Ginkgo*.

Trees with evergreen leaves in two ranks; flowers dioecious, males in catkins or heads, females at the ends of the branches; anthers apiculate, 2-3 celled. Seeds ovoid, or globose, erect with no true aril, but the base of the bract becomes succulent and forms a shallow cup, and the outer investment of the seed becomes fleshy. Germination like that of *Ginkgo*. Van Tieghem notes the presence of a resin canal in the centre of the pith as a characteristic of this genus.

1. *C. drupacea*, Siebold et Zuccarini, *Flora Japon.* ii. t. 130-131; Veitch, 308; Parlatores, 504; Beissner, 183.

Japan.

2. *C. Fortunei*, W. Hook. in *Bot. Mag.* t. 4499; Veitch, 308; Beissner, 183. *Gard. Chron.* Jan. 26, 1884, p. 113.

Introduced from Northern China by Fortune in 1849.

C. Harringtonia, Koch. See *C. pedunculata*.

3. *C. pedunculata*, Siebold et Zuccarini, *Flora Japon.* ii. tab. 133 ; Veitch, 306 ; Beissner, 179, fig. ; Masters in *Gard. Chron.* Jan. 26, 1884, fig. 22 ; and in *Journ. Linn. Soc.* xxii. 201.

SYNONYM:—*Taxus Harringtonia*, Knight.

VARIETIES:—*FASTIGIATA*, syn. *Podocarpus koraianus*, *Taxus japonica hort.* ; *SPHERALIS*, Masters in *Journ. Linn. Soc.* xxii. 103, fig. ; and in *Gard. Chron.* 1884, Jan. 26, p. 117, fig. 23. In the *Revue Horticole*, 1878, p. 116, a monœcious form is figured.

Japan.

C. tardiva. See *Taxus brevifolia*.

C. umbraculifera. See *Taxus brevifolia* (*Kew Index*).

CHAMÆCYPARIS. See *Cupressus* and *Retinospora*.

C. andelyensis or *Retinospora leptoclada* = *Cupressus Thyoides*.

C. Boursieri. See *Cupressus Lawsoniana*.

C. breviramæa. See *Cupressus obtusa*.

C. decussata. See *Thuya occidentalis* form.

C. ericoides. See *Thuya orientalis*.

C. excelsa. See *Cupressus nootkatensis*.

C. filicoides. See *Cupressus pisifera* form.

C. filifera. See *Cupressus pisifera* form.

C. glauca (?). See *Widdringtonia glauca*?

C. Keteleerii (?).

C. Kewensis, hort. See *Cupressus Thyoides*.

C. Lawsoniana. See *Cupressus*.

C. leptoclada. See *Cupressus Thyoides* form.

C. lycopodioides. See *Cupressus obtusa*.

C. nana (?).

C. nootkatensis (variously spelt) = *Cupressus nootkatensis*.

C. obtusa = *Cupressus obtusa*.

C. pendula = *Cupressus obtusa* var

C. pisifera = *Cupressus pisifera*.

C. plumosa = *Cupressus pisifera* form.

C. sphæroidea = *Cupressus Thyoides*.

C. squarrosa = *Cupressus pisifera*.

C. thuixformis (?).

C. thurifera = *Cupressus thurifera*.

CRYPTOMERIA, Don ; Bentham et Hooker, iii. 428 ; Parlatore in *DC. Prod.* xvi. 2, p. 438 ; Eichler, 89, fig. (Tribe TAXODIÆ.)

Evergreen trees with linear leaves, often heteromorphic ; flowers monœcious. Males in axillary spikes, anthers crested 4 or more lobed, pollen-cells globose. Cones globular ; cone-scales palmately divided at the edge, so that the ripe cone is somewhat prickly. Seeds erect, 4-5 to each scale, slightly winged. Cotyledons 2-4, flat, leafy. Primary leaves in whorls of 3.

1. *C. japonica*, Don in *Trans. Linn. Soc.* xviii. 166, f. 1, t. 13 (1841); Parlature, 438; Veitch, 219; *Gard. Chron.* 1845, p. 344; Beissner, 142, figs.; Masters in *Journ. Linn. Soc.* xviii. 498.

SYNONYMS:—*Cupressus japonica*, Linn. f.; *Taxodium japonicum*, Brongn.; *Cryptomeria Fortunei*, Koch.

VARIETIES:—*ELEGANS*, Beissner, 145, fig., a form in which the shape of the primordial leaves is retained. *LOBBI*, introduced from Buitenzorg Garden by T. Lobb. Garden forms: *NANA*, *ARAUCARIOIDES*, *SPIRALIS*, *FASCIATA*, etc. etc.

Introduced from Shanghai by Fortune in 1845. Mountains of Japan and China.

CUNNINGHAMIA, R. Brown; Benthams et Hooker, *Genera Plantarum*, iii. 435; Parlature in *DC. Prod.* xvi. 2. 432; Eichler, l. c. 85, fig. (Tribe *ARAUCARIEÆ*.)

Evergreen trees with flat leaves, monoecious flowers, stamens in terminal umbellate clusters, anthers crested, lobes pendulous, free, three to each anther; pollen spherical. Cones globular. Bracts long, leafy, spreading at the points, adherent below to the seed-scale. Seed-scales persistent, each with three winged pendulous seeds. Cotyledons 2.

1. *C. sinensis*, R. Brown; Parlature, l. c. 432; Forbes, *Pinetum Woburnense*, tab. 57 (1839); Loudon, *Encycl.* 1066, f. 1988; Veitch, 221; Hooker, *Bot. Mag.* 2743; Siebold et Zuccarini, *Fl. Japan.* ii. tab. 203; Beissner, 197, fig. 49; Murray in *Proc. Royal Hort. Soc.* 1862, and in *Pines and Firs of Japan* (1863), 116, figs.

SYNONYMS:—*Belis jaculifolia*, Salisbury (1807), is the oldest name, but it has not been generally adopted. *Pinus lanceolata*, Lambert, *Pinus*, ii. p. 59, t. 37.

VARIETY:—*GLAUCA*.

Southern China.

CUPRESSPINNATA = *Taxodium*.

CUPRESSTELLATA = *Fitzroya*.

CUPRESSUS, Linnæus; Benthams et Hooker, iii. 427 (including *CHAMÆCYPARIS* and *RETINOSPORA* of gardens); Eichler, 99, fig. (Tribe *CUPRESSINEÆ*.)

True Cypresses are known by their scale-like, appressed adult leaves, never in two ranks, monoecious flowers, male flowers spiked, anthers crested—4 or more, pollen globose; cones globular or oblong woody, ripening in the second year, with peltate scales and numerous seeds to each scale. Cotyledons 2, leafy, longer than the primary leaves, which are opposite, or in whorls of 4.

The plants belonging to the subgenus *CHAMÆCYPARIS* (= genus

Chamaecyparis of Spach), Parlature, and others, together with the genus *Retinospora* of Siebold and Zuccarini, differ from the true Cypresses in having generally two-ranked branchlets and flattened branch-systems; smaller cones ripening the first year; the scales less woody, and usually with a smaller number of seeds. They are referred to *THUYA* by Bentham l.c. iii. 427, but in their globular cones, peltate scales, and general habit seem more fitly to belong to the Cypresses.

C. amœna, Koch = *C. funebris*.

1. *C. arizonica*, E. L. Greene in *Bull. Torrey Club*, ix. (1882), 64; Sargent, *Census Report*, 180; Lemmon, *Third Biennial Report*, 1890. Arizona Cypress.

Introduced in 1891.

California, Arizona, New Mexico. See *C. guadeloupensis*.

C. aromatica = *C. Benthamii*.

C. articulata. See *Tetraclinis*.

C. attenuata, Gordon, *Pinet.* ed. 2, 79. A Californian form of uncertain identity—perhaps = *C. Goveniana*.

2. *C. Benthami*, Endlicher, *Synopsis Conif.* p. 59 (1847).

SYNONYMS.:—? *C. thurifera*, Schlechtendal. *C. excelsa*, Scott ex Carrière. *C. Skinnerii*, *elegans*, *aromatica*, *lusitanica*, *Uhdeana*, *Kewensis*, *Huegelii*, are all names connected by Parlature with this species. Synonymy confused and identification uncertain.

Mexico.

C. australis = *Callitris rhomboidea*.

C. bacciformis, Knight = *Juniperus phœnicea* or *occidentalis* (*Kew Index*).

? *C. Balfouriana*, Gordon, *Pinet.* ed. 2, 79.

C. Bourgeauii. See *C. Goveniana*.

C. californica, Florist, 1876. See *C. Goveniana*.

C. cornuta. See *C. Goveniana*.

C. Coulteri. See *C. Lindleii*.

C. excelsa. See *C. Benthamii*.

C. fastigiata. See *C. sempervirens*.

C. flagelliformis. See *C. sempervirens* and *torulosa*.

C. fragrans. See *C. Lawsoniana*.

3. *C. funebris*, Endlicher, *Synopsis Conif.* 58; Veitch, 230; Hooker, *Himalayan Journals*; and in *Gard. Chron.* July 13, 1850, p. 439, fig.; *Journal of Horticulture*, Oct. 8, 1891; *Flor. Brit. Ind.* v. 646.

SYNONYMS.:—*C. pendula*, Staunton. *C. amœna*, Karl Koch.

China (Ichang), Sikkim. Introduced by Fortune in 1846.

C. glandulosa. See *C. Macnabiana*.

C. globulifera, Parl. See *C. sempervirens*.

C. glauca. See *C. lusitanica*.

4. *C. Goveniana*, Gordon in *Journ. Hort. Soc. Lond.* vol. iv. (1849) p. 295, fig.; Parlature, 472; Veitch, 230.

SYNONYMS:—1 *C. californica* (see Carrière, and Florist, 1876, 197).
C. cornuta.

California. Very fragrant. Discovered by Hartweg in 1846 at a height of 1,520 feet, and introduced to the Royal Horticultural Society's Gardens, Chiswick.

5. *C. guadeloupensis*, Watson, *Proc. Amer. Acad.* xiv. 300; *Bot. California*, ii. 114.

SYNONYM:—*C. macrocarpa*, Watson? not Hartweg.

Sargent, *Census Report*, includes with this *C. arizonica*, Greene, which, however, seems different.

C. Hartwegii. See *C. macrocarpa*.

C. Karwinskiana, Regel, *Gartenflora* (1857), 346 = *C. Lindleyi*.

C. kewensis. Referred to *C. Bentharii*.

C. Knightiana. See *C. Lindleyi*.

C. Lambertiana. See *C. macrocarpa*.

6. *C. Lawsoniana* (subgenus *CHAMÆCYPARIS*), Murray, *Bot. Mag.* 5581; *Pinet. Brit.* ii. 191, t. 31; Veitch, 228; Lemaire, *Ill. Hort.* xi. (1863) tab. 367. The Lawson Cypress, also called Port Orford Cedar.

SYNONYMS:—*Chamæcyparis Lawsoniana*, Sargent in *Gard. Chron.* (1881) 8; Beissner, 70; Parlature, 464; Lemmon, *Third Report*, p. 24. *C. Boursieri*, Carrière.

VARIETIES:—The forms and seedling varieties of the Lawson Cypress are exceedingly numerous. *C. ERECTA VIRIDIS*, *Gard. Chron.* 1870, 279, fig. Young's variety, *Gard. Chron.* 1887, p. 176. For an enumeration of the best of the varieties, see Veitch, *Manual*, l. c.; also Beissner, Gordon, and *Garden*, July 24, 1886, p. 75.

North California (Shasta), Oregon. Introduced by W. Murray in 1854. Height 75–100 feet.

7. *C. Lindleyi*, Klotsch (1847), *vide* Endlicher and Parlature, 471.

SYNONYMS:—*C. thurifera*, Lindley; Bentham; not of Humboldt. *C. Knightiana*, Gordon; Veitch, 231. *C. Coulteri*, Forbes; *Pinetum Woburn.* 190 (1839). *C. Karwinskyana*, Regel. *C. lusitanica*, Lindley. *C. Udeana*, Gordon, *vide* Koch. Synonymy confused and identification uncertain.

Mountains of Mexico. Said to be the hardiest of the Mexican Cypresses. Height 60–100 feet.

8. *C. lusitanica*, Miller; Loudon, *Encycl.* 1075, f. 1998; Veitch, 239; Masters in *Gard. Chron.* Dec. 26, 1891, p. 761. The Cedar of Goa.

SYNONYMS:—*C. glauca*, Lamarck; Parlature. *C. pendula*, L'Heritier. *C. Uhdeana*, Gordon, *vide* Parlature.

It seems probable from Portuguese specimens before me that two species are mixed up under this heading. Some of these resemble *C. torulosa*, to which they are referred as forms by Hooker, Willkomm, and others. In gardens, *C. Bentharii* sometimes does duty for *C. lusitanica*.

C. lusitanica, Carrière = *C. Bentharii*.

C. lusitanica, Lindley = *C. Lindleyi* (*Kew Index*).

9. *C. Macnabiana*, Murray, *Descrip. Conif. Californ.* 12, t. 10; Parlature, 473; Veitch, 234; Beissner, 100. *Gard. Chron.* May 28, 1891, p. 403.

SYNONYMS:—*C. glandulosa*, Hook. ex Parlature, 473. *C. glauca*, Depart. of Agriculture, U.S.A., in *Hort. Kew*.

California, Mount Shasta. Alt. 5,000 feet. Introduced by Jeffrey in 1852.

10. *C. macrocarpa*, Hartweg in *Journ. Hort. Soc. Lond.* ii. 187 (1847); Veitch, 234; Parlature, 473; Lemmon, *Third Report*, 1890, t. 25, 26; Beissner, 103; Hooker in *Gard. Chron.* 1849, p. 679, Feb. 7, 1885, with fig.; *Pinct. Brit.* ii. 195, t. 32, 33; Gordon, *Journ. Hort. Soc. Lond.* iv. (1849), 297, fig. Monterey Cypress.

SYNONYMS:—*C. Lambertiana fastigiata*. *C. Hartwegi*, Carrière. *C. Reinwardtii*.

Discovered at Monterey, California, by Hartweg, and introduced for the Royal Horticultural Society in 1848. Height 50-60 feet. Does well by the sea.

C. nepalensis = *C. torulosa*.

C. nivalis = *C. Macnabiana*.]

11. *C. nootkatensis*, Lambert (1803); Loudon, *Arboretum*, fig. 2480; Koch, *Dendrologie*, ii. 165. (Subgenus *CHAMÆCYPARIS*.) Alaska Cypress.

SYNONYMS:—*C. nutkaensis*, W. Hooker in *Flor. Bor. Amer.* ii. p. 165; Veitch, 235; *Pinct. Brit.* ii. 199, t. 34. *Chamæcyparis nutkaensis*, Spach; Parlature, l. c. 465; Beissner, 80. *Thuopsis borealis*, hort. et Carrière. *Thuopsis Tchugatskoy*, hort. *T. Troubetzkoyana*, L. Rovelli. *T. nidifica*, Rovelli.

For the varieties, see Veitch, l. c. 236.

Vancouver's Island, Oregon, British Columbia. Discovered by Menzies in 1794. Likely to be a valuable timber tree.

12. *C. obtusa*, Koch, *Dendrol.* ii. 168. (Subgenus CHAMÆCYPARIS.)

SYNONYMS:—*Chamæcyparis obtusa*, Siebold et Zuccarini; Beissner, 92, fig. *Retinospora obtusa*, Siebold et Zuccarini; Masters in *Gard. Chron.* Feb. 19, 1876, p. 236. *Thuya obtusa*, Masters in *Journ. Linn. Soc.* xviii. 491, fig.

The remarks made under the next species, *C. pisifera*, apply also *mutatis mutandis* to this one.

VARIETIES:—The principal forms are:—LYCOPODIODES; PYGMÆA = *Thuya pygmæa*; NANA; KETELEERII; BREVIRAMEA, of Maximowicz, see Beissner, 97; PENDULA, see Beissner, 97; FILICOIDES, FILIFERA. Several are figured in *Gard. Chron.* 1876, vol. v. p. 236, in Veitch Manual, and in *Journ. Linn. Soc.* xviii. 489 *et seq.*

Mountains of Japan.

C. pendula. See *C. lusitanica*, also *C. funebris* and *Thuya orientalis*.

13. *C. pisifera*, Koch, *Dendrol.* ii. 170.

SYNONYMS:—*Chamæcyparis pisifera*, Siebold et Zuccarini; Parlatore; Beissner, 83, with figs. *Retinospora pisifera*, Siebold et Zucc., *Fl. Jap.* ii. p. 39, t. 122; Veitch, 245; Masters in *Gard. Chron.* Feb. 19, 1876, p. 237; and of most gardens. *Thuya pisifera*, Masters in *Journ. Linn. Soc.* xviii. p. 489.

Mountains of Japan.

VARIETIES:—Of this species there are many forms, and more or less permanent stages of growth, which have in consequence received different names; but, inasmuch as they pass one into the other by intermediate gradations, and as the various forms may be met with on one and the same tree, not only at different times, but sometimes simultaneously, it is obvious that they have no claim to specific rank.

Among these forms which are more or less permanent are:—

a. *SQUARROSA*, a juvenile form, bushy, glaucous, with spreading linear leaves. I have frequently seen specimens bearing cones identical with those of *C. pisifera*, and also with the foliage of that species.

b. *PLUMOSA*, a transition form, between the juvenile and the adult form as to foliage.

c. *FILIFERA*.

The cones of all are identical with those of *C. PISIFERA*. See figs. in *Gard. Chron.* Feb. 19, 1876, p. 236, and *Journ. of Linn. Soc.* l. c.

There are also numerous variegated varieties mentioned in Veitch's Manual, and in garden catalogues. (See *RETINOSPORA*.)

C. pyramidalis. See *C. sempervirens*.

C. Roylei. See *C. sempervirens*.

C. Schomburgkii, Van Houtte. See *C. thurifera* (ex *Kew Index*).

14. *C. sempervirens*, Linnæus; Parlature, 469; Veitch, p. 236; Beissner, 101, fig.; Boissier, *Flor. Orient.* v. 705; Loudon, *Encycl.* 1073, fig. 1996.

SYNONYMS:—*C. fastigiata*, DC. *C. pyramidalis*. *C. Whitleyana*, Carrière.

VARIETIES:—*HORIZONTALIS*, Miller, sp. To this form belong, according to Parlature, in *Prod.* xvi. ii. 468, the forms known as *EXPANSA*, *ORIENTALIS*, *THUYEFOLIA*. The forms known as *TOURNEFORTI*, *RETROFRACTA*, *FLAGELLIFORMIS* probably also belong here. Other varieties are *SPHEROCARPA*, Parlature, from Mount Lebanon; *GLOBULIFERA*, Parlature; *INDICA*, from Nepal = *C. Roylei*, Carrière, *C. Whitleyana*, hort. ex Carrière, *C. Doniana*, hort.; and *UMBILICATA*, Parlature, l. c.

Levant. Himalaya.

C. squarrosa. See *C. pisifera*.

C. thuiæfolia. See *C. sempervirens*.

15. *C. thurifera*, Humboldt, Bonpland, and Kunth, not of Lindley nor of Benthani.

SYNONYM:—*Chamæcyparis thurifera*, Endl. Koch refers *C. Benthani* of Endlicher to this species, as also *C. lusitanica Benthani* of Carrière. Synonymy and identification uncertain.

Mexico.

C. thurifera, Lindley, not H. B. et K. See *C. Lindleyi* (*Kew Index*).

C. thurifera, Schlecht. See *C. Benthani* (*Kew Index*).

16. *C. Thyoides*, Linnæus; Veitch, 229; Loudon, *Arboret.* f. 2327; Forbes, *Pinetum Woburn.* t. 61 (subgenus *CHAMÆCYPARIS*). Seeds, two to each scale. Scales ultimately peltate with a central point.

SYNONYMS:—*Chamæcyparis sphæroidea*, Spach; Parlature, 464; Beissner, 65, fig. *Retinospora ericoides*, of Gordon, not of Veitch, *fide* Syme.

VARIETIES:—*C. KEWENSIS* = *GLAUCA*; *C. VARIEGATA*, *C. NANA*, *C. HOWELL*, *C. LEPTOCLADA*, are garden names applied to forms of this species. To this species also probably belong *Retinospora leptoclada* of gardens, alias *Chamæcyparis sphæroidea andelyensis*, and *Retinospora squarrosa dubia* of some gardens.

17. *C. torulosa*, Don; Parlature 469; Veitch, 239; Beissner; Loudon, *Encycl.* 1076, fig. 1999-2001; *Pinet. Brit.* ii. 201, t. 35; Hook. *Flor. Brit. Ind.* v. 645.

SYNONYM:—*C. Tournefortii*, Tenore, *fide* Parlature?

VARIETIES:—*MAJESTICA*; *CORNEYANA*, Veitch, 239; Parlature, l. c. 469, as a species.

Temperate Western Himalaya.

C. Tournefortii. See *C. sempervirens*.

C. Uhdeana, of Gordon, is a doubtful form referred to *C. glauca* (*Iusitanica*) by Parlatores, and to *thurifera* by others. *C. Uhdeana*, of Carrière, and of gardens, is referred by the same authority to *C. Bentharii*.

C. umbilicata = *C. sempervirens*.

C. Whitleyana = *C. sempervirens*.

Cypress = CUPRESSUS.

Cypress, Deciduous. See *Taxodium distichum*.

DACRYDIUM, Solander (1786); Benthani et Hooker, *Genera Plantarum*, iii. 433; Parlatores, in *DC. Prod.* xvi. 2, 493; Kirk, *Forest Flora of New Zealand*, where several species are figured; Eichler, 103. (TAXACEÆ, Tribe TAXEÆ.)

Evergreen trees with dioecious flowers and variable foliage. Male flowers spiked, anther-crested, 2-lobed, opening transversely, pollen cells winged. Seed partly inverted, or ultimately erect, with an outer short, cupuliform aril, and an inner, generally dry seed-coat investing the kernel.

1. *D. cupressinum*, Solander; Parlatores, 494; Forbes, *Pinetum Woburn*. t. 67; Kirk, *Forest Flora of New Zealand*, tabs. xviii.-xxii.

New Zealand. "*Arbor pulcherrima*." Too tender for out-door growth. Suitable for conservatory decoration.

D. ferrugineum, Van Houtte = *Podocarpus dacrydioides* (*Kew Index*).

2. *D. Franklinii*, Hook. fil. in *London Journal of Botany*, iv. (1845), p. 152, tab. 6; and *Flora of Tasmania*, p. 357, t. 100.

The Huon Pine, height 80-100 feet.

South and west shores of Tasmania.

3. *D. laxifolium*, Hooker; Gordon, *Pinet.* ed. 2, 107; Kirk, *Forest Flora of New Zealand*, tab. 87.

"The least of all conifers," fruiting sometimes when no higher than two inches.—Kirk.

Mountains of New Zealand.

D. Maii. See *Podocarpus spicatus*.

D. Pancherii, Brongn. and Gris. See *Podocarpus pectinata*.

Other species are grown under glass.

Deal, white = *Picea excelsa*.

Deal, yellow or red = *Pinus silvestris*.

DAMMARA. See *Agathis*.

DEODAR. See *Cedrus*.

Firs. See *Abies*.

Firs, Spruce. See *Picea*.

FITZROYA, J. D. Hook. (1851); Benth. et Hook. iii. 425. *Bot. Mag.* t. 4616. Lindley, in *Paxton Fl. Garden*, ii. p. 147, n. 387; *Journ. Hort. Soc. Lond.* vi. p. 264, **DISELMA**. (Tribe **CUPRESSINEÆ**.)

Evergreen shrubs with 3-ranked leaves, and dicecious flowers. Anther crested, 2-lobed, pollen globose. Cones solitary, terminal, globose; of 2-3 rows of whorled scales, of which only the upper are fertile. Ovules 2-3, erect. Seeds 2-3, winged.

1. *F. patagonica*, Hooker. Height, 50-80 feet. Mountains of Western Patagonia, Chile, Valdivia. Introduced by W. Lobb, through Messrs. Veitch, in 1849.

FRENELA. See *Callitris*.

GINKGO, Linnæus; Bentham and Hooker, *Genera Plantarum*, iii. 432; Parlature, in *DC. Prod.* xvi. 2, 506; Eichler, 109, fig. (**TAXACEÆ**, Tribe **SALISBURIEÆ**.)

A tree with deciduous, stalked, fan-shaped leaves, arranged either in tufts on spurs, or scattered on long shoots. Male flowers in umbellate pendulous spikes or catkins. Anthers 2-celled. Pollen cells oval. Female flowers on separate trees. Seed erect, ovoid, with no aril, but covered with a fleshy coat. Cotyledons 2, hypogeal. According to Van Tieghem, there are two resin canals in the pith of this tree; one only in *Cephalotaxus*, and none in other Conifers.

1. *G. biloba*, Linnæus (1771); Parlature, l. c. 507; Veitch, l. c. 313, c. ic.; Beissner, 189, figs. 47, 48. *Gard. Chron.*, March 2, 1889, pp. 265, 269 (germination).

SYNONYM:—*Salisburia adiantifolia* (1797), Smith; Loudon, *Encycl.* fig. 1757.

The Maidenhair tree. Northern China. Cultivated in Japan. There is a golden-leaved form, as well as others which differ slightly in the foliage.

GLYPTOSTROBUS, Endlicher; Parlature, in *DC. Prod.* xvi. 2, 438. Bentham and Hooker include it under *Taxodium*; Eichler, 91. (Tribe **TAXODIÆÆ**.) The only species is a tree with minute deciduous leaves; male flowers in short catkins. The winged seeds, though described as erect, are in reality pendulous. The scales of the cone are club-shaped at the extremity, but scarcely so peltate as in *Taxodium*, and they are grooved on the inner surface for the reception of the seeds.

1. *G. heterophyllum*, Endlicher.

SYNONYMS:—*G. pensilis*, Staunton; Koch, *Dendrol.* ii. 191. *Taxodium heterophyllum*, Brongniart; Beissner, 154. *Horsfieldi*, Knight. *T. sinense*, Forbes, *Pinet. Woburn*. p. 179.

South China.

G. pendulus, *Bot. Mag.* t. 5603, is *Taxodium distichum* var. **PENDULA**,

Hemlock Spruce. See *Tsuga*.

HESPEROPEUKE. See *Tsuga Pattoniana*.

HEYDERIA. See *Libocedrus*.

JUNIPERUS, Linnæus; Bentham and Hooker, iii. 427; Parlature in *DC. Prod.* xvi. 2, 475; Eichler, 101, fig. (Tribe CUPRESSINEÆ.)

Easily recognised by the peculiar odour and by the globular cones of 3-6 fleshy, valvate scales in which the erect seeds are imbedded. Male flowers in spikes, anthers crested, 3-4-lobed, pollen globose. Embryo with 2 blunt leafy cotyledons. Primary leaves pointed.

J. alpina. See *J. communis*; also *J. sibirica* and *J. Sabina*.

J. argentea, hort. See *J. virginiana*.

J. aromatica, hort. See *Cupressus Goveniana*.

J. australis, hort. See *J. virginiana*.

J. bacciformis, hort. See *J. phœnicea*.

1. *J. bermudiana*, Linnæus; Parlature, 497; Veitch; Hemsley in *Gard. Chron.* May 26, 1883, p. 657, fig.; Sargent in *Garden and Forest*, June 24, 1891.

Bermudas.

?*J. Bregeonii*, Regel, *Ind. Sem. Petrop.* 1858, p. 23.

2. *J. californica*, Carrière, *Traité*, 58; *Rev. Hort.* 1854, 353, fig.; Beissner, 129; Gordon; Watson, *Bot. Californ.* ii. 113; Sargent, *Census Report*, 180.

SYNONYMS:—*J. tetragona*, var. *osteosperma*, Torrey. *J. tetragona*, Cooper, not Schlechtendal. *J. occidentalis*, Gordon, in part; Parlature, in part; Hoopes, *Evergreens*, in part; Sargent.

VARIETIES:—UTAHENSIS, Lemmon, *Third Report*, 28; Veitch, 289.

Utah, Arizona, California.

3. ?*J. cæsia*, Regel, *Index Sem. Hort. Petrop.* 1858.

J. canadensis. See *J. communis* var.

J. Caninaertii, hort. See *J. virginiana*.

J. caroliniana. See *J. virginiana*.

4. *J. Cedrus*, Webb; Parlature, 478.

Canaries.

5. *J. chinensis*, Linnæus; Parlature, 487; Veitch, 287; Beissner, 118, fig.; Loudon, *Encycl. Trees*, 1089, fig.; Siebold et Zuccarini, *Fl. Jap.* ii. tab. 126, 127.

The male plant differs in appearance from the female.

SYNONYMS:—*J. japonica*, Carrière. *J. flagelliformis* and *J. Reevesiana*, hort.

VARIETIES: Veitch admits the following varieties: CHINENSIS AUREA, CHINENSIS ALBO-VARIEGATA; while to the form known as JAPONICA are assigned *J. AUREA* and AUREO-VARIEGATA.

Himalaya, China, Japan.

J. Chamberlainii. See *J. virginiana*.

J. cinerascens. See *J. virginiana*.

J. cinerea. See *J. thurifera*.

6. *J. communis*, Linnæus ; Parlature, 479 ; Veitch, 274 ; Beissner, 133 ; Boissier, *Flor. Orient.* v. 707 ; Hook. *Flor. Brit. Ind.* v. 646 ; Macoun, *Cat. Canad. Plants*, 462 ; Loudon, *Encycl.* 1081, f. 2014, &c.

VARIETIES :—Parlature admits the following as varieties :—1, FASTIGIATA, including *suecica*, *hibernica*, *stricta* and *hispanica* of gardens and of some authors ; 2, REFLEXA, including *J. c. caucasica*, *oblonga* of Gordon, not of Bieberstein ; 3, OBLONGA, Bieberstein, Antoine, Carrière ; 4, HEMISPHERICA ; 5, ALPINA, Gaudin, Macoun, 462, including *nana*, Gordon, Carrière ; *canadensis*, Loddiges, Gordon, Veitch, Carrière, and *dealbata*, Loudon. Veitch also names as distinct varieties, COMPRESSA, CRACOVIA (of Loddiges), NEABORIENSIS. The name *J. "oblonga pendula* of gardens" is sometimes applied to a form of this species, sometimes to *J. taxifolia*.

Wild throughout the greater part of the Northern and Eastern Hemisphere ; rare in America. A most variable and multiform plant, differing not only according to locality, but in different stages of growth.

7. *J. davurica*, Pallas ; Parlature, 482 ; Beissner, 107.

Altai Mountains.

8. *J. drupacea*, Labillardière ; Parlature, p. 476 ; Veitch, 276 ; Boissier, *Flor. Orient.* v. 706 ; Beissner, 140 ; Loudon, *Encycl.* 1804, f. 2019. *Gard. Chron.*, July 15, 1854, p. 455. "*Habhel fructus toto oriente notissimus.*"

SYNONYM :—*Arceuthos drupacea*, Antoine and Kotschy.

Height 20–25 feet. Introduced by Kotschy in 1854 from the mountains of northern Syria. Crete.

J. dumosa. See *J. squamata* (*Kew Index*).

? *J. duplicata*, Goeppert, *Index Sem. Hort. Wratislav.* (Breslau), 1871.

J. echiniformis, hort. ex Carrière = *J. Oxycedrus* or *J. nana* (*Kew Index*).

J. elliptica, Koch = *J. communis*.

J. ?ericoides, hort. = *Retinospora juniperoides* or *R. dubia*.

9. *J. excelsa*, Bieberstein ; Parlature, 484 ; Loudon, *Encycl.* 1083 figs. ; Veitch, 279 ; Beissner, 112 ; Boissier, *Flor. Orient.* v. 708.

SYNONYMS :—? *J. taurica*, and ? *J. religiosa*.

VARIETY :—STRICTA, Veitch.

Levant, Himalaya, Afghanistan to Sikkim.

J. fastigiata. See *J. communis*.

J. flagelliformis, Loudon. See *J. chinensis* (*Kew Index*).

10. *J. foetidissima*, Willdenow ; Boissier, *Flor. Orient.* v. 710.

J. formosa, hort. See *J. phœnicea* (*Kew Index*).

J. Fortunei, hort. See *J. sphærica* or *macrocarpa* (*Kew Index*).

J. fragrans, Knight. See *J. Hermannii* (*Kew Index*).

J. fragrans, Paul. See *J. cæsia* (*Kew Index*).

J. glauca, hort. See *J. virginiana*.

J. Gossainthaineana. See *J. virginiana* and *J. macropoda*.

J. gracilis, hort. See *Cupressus torulosa* Corneyana.

J. hibernica, hort. See *J. communis*.

J. himalayensis, hort. (?)

J. hispanica, hort. See *J. communis*.

J. hudsonica, Forbes. See *J. Sabina*.

J. Lycia. See *J. phœnicea*.

J. lusitanica. See *J. Sabina*.

J. malacocarpa, Carr. See *J. phœnicea*.

11. *J. macrocarpa*, Sibthorp ex Parlatores, . 476 ; Veitch, 277 ; Beissner, 139 ; Boissier, *Flor. Orient.* v. 706 ; Loudon, *Encycl. Trees*, 1083, f. 2017.

Height 10-12 feet.

Mediterranean coast.

12. *J. macropoda*, Boissier, *Flor. Orient.* v. 709 ; Hook. *Flor. Brit. Ind.* v. 647.

Persia, West Himalaya—not in cultivation ; perhaps not distinct from *J. excelsa*.

J. meldonensis. See *Thuya*, § Biota.

J. nana. See *J. communis*.

J. nepalensis. See *J. recurva*.

13. *J. mexicana*, Schiede, Parlatores, 491.

SYNONYM:—*J. gigantea*, Roezl.

Mountains of Mexico.

14. *J. occidentalis*, W. Hooker, *Flor. Bor. Am.* ii. 166 ; Parlatores, 489, partly ; Veitch, 289 ; Macoun, 461 ; Beissner, 128 ; Lemmon, *Third Report*, t. 27.

SYNONYMS:—*Chamæcyparis Boursierii*, Decaisne *vide* Parlatores.

J. pyriformis, Lindley in *Gard. Chron.* 1855, p. 420.

VARIETY:—MONOSPERMA, Engelm.

North-Western America, British Columbia to Sacramento.

15. *J. Oxycedrus*, Linnæus ; Parlatores, p. 476 ; Veitch, 277 ; Beissner, 138 ; Boissier, *Flor. Orient.* v. 707 ; Loudon, *Encycl.* f. 2015.

SYNONYMS:—*J. rufescens*, Link. *J. Marshalliana*, Steven ex Boiss.

J. Biebersteiniana, hort. ex Koch, *Dendrol.* ii. 112.

Southern Europe, the Levant,

16. *J. pachyphloea*, Torrey ; Parlature, 490 ; Veitch, 289 ; Gordon ed. 2, 164.

New Mexico and Arizona.

J. pendula, hort. See *Cupressus torulosa*, var. *Corneyana*.

17. *J. phœnicea*, Linnæus ; Parlature, 486 ; Veitch, 290 ; Beissner, 116 ; Boissier, *Flor. Orient.* v. 710 ; Loudon ? *Encycl.* 1087, fig.

SYNONYMS :—*J. bacciformis*, Carr., *J. Langoldiana*, *J. tetragona*.

VARIETIES :—*TURBINATA*, Parlature, l. c. ; *FILICAULIS*, Carrière.

Introduced in 1683 by Sutherland. Mediterranean region, Azores, Madeira.

J. procumbens. See *J. squamata* and *J. chinensis*.

J. pyramidalis, hort. See *J. communis*, *Hermannii*, *phœnicea*, and *Bermudiana*.

18. *J. pseudo-Sabina*, Fischer and Meyer ; Parlature, 482 ; Beissner, 106 ; Hook. *Flor. Brit. Ind.* v. 646.

Siberia.

J. pyriformis, Murray in *Gard. Chron.* 1855, 420. See *J. occidentalis*.

19. *J. recurva*, Hamilton ; Parlature, p. 481 ; Veitch, 278 ; Beissner, 104 ; Loudon, *Encycl. Trees*, 1089, fig. ; Masters in *Gard. Chron.* 1883, April 14, p. 468, fig. ; Boissier, *Flor. Orient.* v. 708 ; Hook. *Flor. Brit. Ind.* v. 647.

Himalayas, Cashmir to Sikkim.

VARIETY :—*SQUAMATA*.

Himalaya, China, Japan.

20. *J. rigida*, Siebold et Zuccarini, *Flor. Japan.* ii. p. 109, t. 125 ; Parlature, 480 ; Veitch, 277.

Introduced, in 1861, from the mountains of Japan by Mr. J. G. Veitch.

J. rigida, Gordon. See *J. taxifolia*.

21. *J. Sabina*, Linnæus ; Parlature, p. 483 ; Boissier, *Flor. Orient.* v. 708 ; Veitch, 278 ; Beissner, 107, fig. ; Loudon, *Encycl.* 1085, figs.

VARIETIES :—*PROCUMBENS*, Veitch ; Macoun, 463. Veitch admits as varieties *TAMARISCIFOLIA* and *VARIEGATA*. Other varieties are *HUMILIS*, *PROSTRATA*, *HUDSONICA*, *REPENS*, *CÆSIA*, *REPANDA*.

Central and Southern Europe, Caucasus, Siberia, North-Eastern America.

J. sabinoides, Lindl. and Gord. in *Journ. Hort. Soc. Lond.* v. 202 = *J. mexicana* (*Kew Index*).

J. saxatilis, hort. See *J. communis*.

J. Schottii, hort. See *J. virginiana*.

J. Shepperdii, hort. See *J. chinensis*.

22. *J. semiglobosa*, Regel, ex Beissner, 107.

Turkestan.

J. sibirica. See *J. dahurica*.

23. *J. sphærica*, Lindley in *Paxton Flower Garden*, i. (1850) f. 35 ; Parlatore, 488 ; Veitch, 290 ; Beissner, 121.

VARIETY :—*SHEPPARDII*, Veitch, l.c. 290.

Introduced from Northern China by Fortune in 1846.

J. squamata, Gordon. See *J. pseudo-Sabina*.

J. stricta. See *J. excelsa*.

J. struthiacea, Knight. See *J. excelsa*.

J. suecica, Miller. See *J. communis*.

J. tamariscifolia. See *J. Sabina*.

J. taurica, hort. ; Lindley et Gordon, *Journ. Hort. Soc.* v. (1850)

200. See *J. communis*.

24. *J. taxifolia*, Hooker and Arnott, *Beechey Voy.* 271 ; Parlatore, 481.

SYNONYM :—*J. oblonga pendula* of some gardens.

Japan and China.

25. *J. thurifera*, Linnæus ; Parlatore, 487 ; Veitch, 282 ; Beissner, 118 ; Loudon, *Encycl.* 1088, f. 2029.

Introduced in 1752 by Miller. Spain, Algiers. (See also under *J. cinerea*, *phœnicea*, and *foetidissima*.)

J. Udeana. See *Cupressus Coulteri*.

J. wifera, Don, referred doubtfully to *Libocedrus tetragona* by Parlatore, and to *recurva* by others.

J. venusta, hort. See *J. excelsa*.

26. *J. virginiana*, Linn. ; Parlatore, 488 ; Veitch, 283 ; Loudon, *Arboret.* f. 2357 ; Beissner, 123 ; *Gard. Chron.* March 31, 1877, p. 405, 407 ; Macoun, 462 ; Loudon, *Encycl.* 1084, f. 2020. The Red Cedar.

VARIETIES :—Parlatore enumerates :—*GLAUCA* (Carrière), *BEDFORDIANA* (Knight), syn. *gracilis* ; *Gossainthainea* (Carrière) ; *barbadensis* (Gordon). Other varieties are: *ARGENTEA*, *AUSTRALIS*, *AUREO-VARIEGATA*, *CANNAERTI*, *DUMOSA*, *PENDULA*, *CHAMBERLAINI*, *SCHOTTI*, *TRIPARTITA*, and others given by Beissner.

North America, from Hudson's Bay to Florida ; and on the west side in Colorado and Vancouver's Island.

J. Webbii, Carr. See *Cedrus*.

J. Whitleyana. See *Cupressus sempervirens*.

J. Wittmanniana. See *J. communis* and *J. Oxycedrus*.

Kauri Pine = *Agathis australis*.

KETELEERIA, Carrière in *Revue Horticole*, 1866, and May 1887; *Traité*, ed. 2, 260; Pirotta, *Bull. Soc. Toscan. di Orticultura* (1877), p. 269. **ABIES**, Benthams and Hooker, iii. 442. See Franchet, *Pl. Davidiana*, 1884, c. ic. (Tribe ABETINEÆ.)

Evergreen trees with flat leaves and scaly buds. Male spikes in tufts or umbels. Anthers opening transversely. Pollen-grains two-winged. Cones erect, lateral; scales long-persistent, but ultimately separating one from another. Bracts shorter than the scale. Seed winged.

1. **K. Fortunei**, Carrière, *Revue Horticole*, 1866, c. ic.; et *Traité des Conif.* ed. 2, p. 260; Beissner, 421, fig. 116; Masters in *Gard. Chron.* March 15, 1884, fig.; April 3, 1886, 1889, 689; and in *Journ. Linn. Soc.* xxii. 197, figs.; *Garden*, Feb. 23, 1889, ex *Revue Horticole*; Mayr, *Mon. Abiet. Jap.* (1890), p. 99.

SYNONYMS:—*Abies Fortunei*, Lindley in *Gard. Chron.* 1850, p. 311; Veitch, 124. *A. jezoensis*, Lindl. (non Siebold), *Gard. Chron.* May 18, 1850, p. 311. *Picea Fortunei*, Murray. *Pinus Fortunei*, Parlatores, 430.

Eastern China. Introduced by Fortune.

2. **K. Davidiana**, Franchet, China. See Masters in *Gard. Chron.* 1889; *Florist*, 1874, p. 125, c. ic. (sub. nom. *Pseudotsuga*).

3. **K. sacra**, Franchet, China; not yet in cultivation.

Larch. See **LARIX**.

Larch, Golden. See **PSEUDOLARIX**.

LARIX, Miller; Benthams et Hooker, *Gen. Plant.* iii. 442; Eichler, *Pflanzenfamilien*, ii. 69, fig.

Pinus, section *Larix*, Endlicher; Parlatores in *DC. Prod.* xvi. 409. (Tribe ABETINEÆ.)

Trees with long shoots and scattered foliage, or with short spurs and leaves in tufts; the leaves in both cases linear, deciduous, soft. Male flowers in short spikes, anthers apiculate, 2-lobed, dehiscing transversely. Pollen grains very large, globose. Cone-scales woody, persistent. Seed without resin canals. Wing of seed oblong, acute. Cotyledons 6-8 3-cornered or flat, entire. Primary leaves entire (Tubef.)

L. americana. See *L. pendula*.

L. archangelica. See *L. sibirica*.

1. **L. davurica**, Fischer; Parlatores, l. c. 410; Veitch, 127; Beissner, 328, fig. 90, ex *Gartenflora*, 1871.

VARIETIES:—**PROSTRATA**, Regel. **JAPONICA**, Maximowicz; Beissner, 329, ex *Gartenflora*, 1871.

Siberia.

L. chinensis. See *Cunninghamia sinensis*.

L. communis. See *L. europæa*.

L. decidua. See *L. europæa*.

2. *L. europæa*, De Candolle, *Fl. Française* (1805), ex Tournefort, *Inst.* t. 357, iii. 277; Loudon, *Arboretum*, iv. 2350, with figs.; Veitch, 127; Beissner, 321; Loudon, *Encycl.* 1054, f. 1972; *Kew Index MSS.* The parent larches at Dunkeld, *Gard. Chron.* Feb. 12, 1876, p. 209, fig. The Common Larch.

SYNONYMS:—*Pinus Larix*, Linnæus; Parlatore, 411; Lambert, *Pinus*, ed. 2, t. 35. *Larix excelsa*, Link. *Larix decidua*, Miller, *Dict.* (1759); the earliest name, but not generally adopted; Koch, ii. 258; Richter, *Pl. Europ.* i. 4. *Abies Larix*, Poiret. *Larix pyramidalis*, Salisbury in *Linn. Trans.* viii. 313 (1805).

VARIETIES:—PENDULA, *Gard. Chron.* Dec. 3, 1887, p. 685, fig.; and 1888, April 7; *L. EUROPÆA* var. *SIBIRICA*, Loudon, *Arboretum*, 2352. See also Beissner, 325, for other varieties.

Alps.

L. Fraserii. See *L. europæa*.

3. *L. Griffithii*, Hook. fil. in *Illustr. Himalayan Plants*, t. 31, and in *Gard. Chron.* June 5, 1886, p. 718; Masters in *Gard. Chron.* 1886, Oct. 9, fig.; Veitch, 128; Beissner, 317, fig.

SYNONYMS:—*Pinus Griffithii*, Parlatore, 411. *Abies Griffithiana*, Lindley and Gordon.

Eastern Himalayas.

L. intermedia. See *L. europæa* var. *sibirica*.

L. japonica, Murray. See *L. leptolepis*.

L. Kämpferii. See *Pseudolarix*.

4. *L. kurilensis*, Mayr, *Mon. Abiet. Japan.* 66, t. 5, f. 15.

Kurile Islands.

L. laricina. See *L. pendula*.

5. *L. leptolepis*, Endlicher; Parlatore, 410; Gordon; Veitch, 130; Beissner, 318, fig.; Masters in *Gard. Chron.* Jan. 20, 1883, p. 88, fig.; Mayr, *Mon. Abiet. Jap.* 63, t. 5, fig. 14.

SYNONYMS:—*Abies leptolepis*, Siebold and Zuccarini, *Flor. Jap.* t. 103; Lindl. and Gordon in *Journ. Hort. Soc.* v. 213. *L. japonica* Carrière.

VARIETIES:—MURRAYANA, Maximowicz, *Ind. Sem. Petrop.* 1866; Beissner, 319, fig. 84, ex *Gartenflora*, 1871. = *L. japonica*, Murray. Pines and Firs of Japan, p. 94, fig.

Introduced in 1861 from Japan by J. G. Veitch. According to Mayr this is the plant originally called *Pinus Kämpferi* by Lambert. See *Pseudolarix*.

6. *L. Lyallii*, Parlature in *Gard. Chron.* 1863, 916; Regel, *Gartenflora*, xiii. 244; xxx. 103; Carrière; Hoopes, *Evergreens*, 256; Veitch, 130; Sargent, 216; and in *Gard. Chron.* May 22, 1886, 652, fig.; Beissner, 314, fig.; Macoun, 476.

SYNONYM:—*Pinus Lyallii*, Parlature, 412.

Cascade Mountains.

L. microcarpa. See *L. pendula*.

7. *L. occidentalis*, Nuttall, *Sylva*, iii. t. 120; Hoopes, *Evergreens*, 253; Regel, *Gartenflora*, xx. 103, t. 685; Veitch, 130; Sargent, 216; and in *Gard. Chron.* May 22, 1886, p. 652, fig.; Beissner, 314, fig.; Macoun, 475.

SYNONYMS:—*Pinus Larix*, Douglas MSS., not of Linnæus. *L. americana*, var. *brevifolia*, Carrière. *Pinus Nuttallii*, Parlature, 412.

British Columbia, Oregon.

8. *L. pendula*, Salisbury in *Linn. Trans.* viii. p. 313 (1805); Forbes, *Pinet. Woburn*. t. 46; Carrière; Gordon.

SYNONYMS:—*Pinus microcarpa*, Lambert. *L. microcarpa*, Forbes, *Pinet. Woburn*. t. 47; Veitch, 180; Carrière; Gordon. *L. americana*, Michaux (1813); Beissner, l. c. 329; Macoun, 475; Loudon, *Encycl.* 1056, f. 1973. *Abies pendula* and *A. microcarpa*, Lindley and Gordon. *Pinus laricina*, Duroi. *P. pendula*, Aiton; Lambert, ed. 1, t. 36; Parlature, 409. *P. microcarpa*, Lambert, ed. 1, t. 37. The American Larch, Tamarack or Hackmatack.

L. sibirica = *L. europæa sibirica*, Loudon.

L. rossica. See *L. europæa*.

L. vulgaris. See *L. europæa*.

LIBOCEDRUS, Endlicher; Benth. et Hook. iii. p. 426; Parlature, 453; Eichler, 95, fig. (Tribe CUPRESSINÆ.)

Trees with flattened branch systems, leaves small flattened decussate, male flowers in spikes, anther-lobes 4; cones oblong, woody, with 2-6 valvate scales, of which the middle pair is alone fertile. Seeds with 2 unequal wings. Cotyledons 2.

Several of the New Zealand species are figured in Kirk's *Forest Flora* of that colony.

1. *L. Bidwillii*, Hook. f. *Handbk. Fl. N. Zealand*, p. 257 (1867).

New Zealand. Conservatories.

2. *L. chilensis*, Endlicher; Veitch, 267; *Gard. Chron.* 1850, p. 439, fig.

SYNONYM:—*Thuja chilensis*, Don; Hook. in *Lond. Journ. of Botany*, ii. p. 199, t. 4.

Chilian Andes.

Tree 60-80 feet, or low shrub according to locality; rather tender in this country.

3. *L. decurrens*, Torrey; Veitch, *Man.* 267; *Woods and Forests*, Feb. 27, 1884; Parlature, 456; Brown Campst. in *Trans. Bot. Soc. Edinb.* ix. 373; Hoopes, *Book of Evergreens*, f. 40; Beissner, 28, with figures; Lemmon, *Third Report*, 22, 23.

SYNONYMS:—*Thuya Craigiana*, Murray. *Heyderia decurrens*, Koch. *Thuya gigantea* of gardens, but erroneously so called.

VARIETIES:—*GLAUCA*, *COMPACTA*.

Introduced by Jeffrey in 1853. Mountains of North-Western America.

L. Craigiana. See *Thuya gigantea*.

4. *L. Doniana*, Endlicher; Parlature, 454; Veitch, 267; Hook. *Handb. N.Z. Flora* (1867), 256; Kirk, *Forest Flora of New Zealand*, tab. 82, 83.

SYNONYM:—*Thuya Doniana*, Hooker, *Lond. Journ. Bot.* i. t. 18. New Zealand. Height 30 feet. Conservatory.

5. *L. tetragona*, Endlicher; Veitch, 267; *Gard. Chron.* 1850, p. 439, fig.

SYNONYM:—*Thuya tetragona*, W. Hooker in *Lond. Journ. of Botany*, iii. p. 144, t. 4. "Alerse."

Patagonia and Chile.

Height 40-80 feet. Does not succeed well out of doors near London.

Maidenhair tree = *Ginkgo biloba*.

MICROCACHRYS, Hook. fil. (1845) Benth. et Hook. *Gen. Plant.* iii. 433; Eichler, 103. (TAXACEÆ, Tribe *PODOCARPEÆ*.)

Trees with delicate overlapping foliage. Anthers in spikes, 2-celled; pollen-cells winged. Seed small, inverted from the top of the bract, surrounded at the base by a fleshy scarlet aril. (*Dacrydium* partly.)

1. *M. tetragona*, Hook. f. *Flor. Tasmania*, i. 358, t. 100 (1860); *Bot. Mag.* 5576.

SYNONYM:—*Dacrydium tetragonum*, Parlature in *DC. Prod.* xvi. 2, 496.

Mountains of Tasmania. Grown for conservatory decoration, for which its elegant habit, neat foliage, and red fruits commend it.

NAGÆIA. See *Podocarpus*.

PHYLLOCLADUS, L. C. Richard; Benth. et Hooker, *Genera Plantarum*, iii. 433; Parlature in *DC. Prod.* xvi. 2, p. 498; Eichler, 109; Kirk's *Forest Flora of New Zealand*, wherein several species are figured. (TAXACEÆ, Tribe *TAXEÆ*.)

The peculiar character of the genus resides in the expanded leafy branches which are divided at the edges and sterile. The fertile

branches are contracted into stalks, at the end of which the female flowers are clustered, each consisting of an erect ovule surrounded at the base by an aril. The adjacent bract and the top of the stalk also become fleshy. The male spikes are in clusters at the ends of the branches, anthers 2-celled, with a pointed crest. Cotyledons 2, leafy, primary leaves linear.

One or two species are grown in conservatories, such as *P. TRICHOMANOIDES*, Don, and its variety *GLAUCA* from New Zealand, and *P. RHOMBOIDALIS* from Tasmania; *P. ALPINUS* of Hook. fil., Gordon, and others, is an alpine form of *TRICHOMANOIDES*.

PICEA, Link (1827); Bentham et Hooker, *Genera Plantarum*, iii. 439; Eichler, *Pflanzenfamil.* ii. 70. The Spruce Firs. (Tribe ABIE-TINEÆ.)

According to modern and now almost universally followed usage, the Spruce Firs are included under *Picea*, whilst the Silver Firs are placed under *Abies*. The reader should therefore, in case of need, search under *Abies*, or even under *Pinus*, for names not found under the present heading.

The leading characteristics of the Spruce Firs are: the projecting cushions at the base of the leaves, which give a rough, pegged appearance to the shoots; the four-sided leaves (flat in the section *Omorica*), uniform in structure; the usually pendulous woody cones, ripening in the first year, and the scales of which do not fall away one from the other as in the Silver Firs. Bracts concealed, not projecting, free from the scales except at the base. Stamens in spike-like masses. Anthers 2-lobed, apiculate. Pollen-cells winged. Seeds small. Seed-wings obovate, separable, covering the upper side of the seed. Cotyledons 8-10, 3-sided, toothed, primary leaves flat, denticulate. Willkomm makes two sections—§ *Eupicea* with four-sided leaves; and § *Omorica* with flattish leaves with stomata and white bands on the upper surface.

P. acicularis, Maximowicz; Beissner, 380 (not of gardens), is cited as the *Picea japonica* of gardens. See *Picea Alcockiana*.

1. *P. ajanensis*, Fischer; Masters in *Gard. Chron.* 1880, Jan. 24, p. 115, 213; October 2, 1880, p. 428, fig.; Jan. 14, 1888, p. 53, cone; 1882, August 5, p. 183; and in *Journ. Linn. Soc.* xviii. 508; Beissner, 385, fig.; Mayr, *Mon. Abiet. Japan*, 53, t. 4. (§ *OMORICA*.)

SYNONYM:—*Abies ajanensis*, Veitch, 63.

VARIETY:—*microsperma* = *P. ajanensis japonica*, Maximowicz. Amoor-land, Mountains of Japan.

2. *P. alba*, Link; Engelmann in *Gard. Chron.* 1879, 334; Beissner, 340, fig.; Macoun, 469.

SYNONYMS:—*Abies alba*, Michaux; Loudon, *Arbor.* 2224; *Encycl. Trees*, 1030, f. 1928; *Pinet. Woburn.* t. 33; Veitch, 63, *A. canadensis*,

Miller. *Pinus alba*, Lambert, ed. 1, t. 26; Parlature, 414. *Abies rubra* var. *cærulea*, Loudon, *Arboret.* 2310. *A. cærulea*, Forbes, *Pinet. Woburn.* 99. *P. cærulea*, Link. *P. nigra* var. *glauca*, Carrière. *A. arctica*, Murray in *Journal of Botany*, v. tab. 69 (1867).

Arctic North America, and south to New England States.

3. *P. Alcockiana*, Masters in *Gard. Chron.* Feb. 14, 1880, p. 212, fig.; *Journ. Linn. Soc.* xviii. 509; Beissner, 377, fig.

SYNONYMS:—*Abies Alcockiana*, Veitch, 67. *Picea bicolor*, Maximowicz; Mayr, *Mon. Abiet. Japan*, 49, t. 3. *A. acicularis* and *excelsa acicularis* of gardens.

Mountains of Japan. Discovered and introduced by John Veitch.

P. bicolor above cited is sometimes applied to *P. ajanensis* in gardens.

P. bifolia, Murray. See *Abies lasiocarpa*.

4. *P. Breweriana*, Watson (1885); Sargent in *Gard. Chron.* April 17, 1886, 497, f. 93; *Garden and Forest*, 1890, p. 63; Lemmon, *Third Report*, p. 116, figs. 4, 5, 6.

North California, Siskiyou Mountains, at altitude of 5,000 feet. Only known at present from one limited district.

P. californica, Carrière = *Tsuga Pattoniana*.

P. concolor. See *Abies concolor* and *A. Lowiana*.

5. *P. Engelmannii*, Engelmann; *Gard. Chron.* 1879, 334; 1882, 145; Beissner, 343, fig.; Macoun, 471.

SYNONYMS:—*Pinus commutata*, Parlature, 417 partly. *Abies Engelmannii*, Parry, *Gard. Chron.* 1863, 1035; Sargent in *Gard. Chron.* 1877, 631; Veitch, 68; Lemmon, *Third Report*, 113, f. 2.

Of this there is a glaucous form not to be confounded with *P. pungens glauca*.

Rocky Mountains of Montana, Oregon, south to Arizona.

6. *P. excelsa*, Link; Beissner, 351; *Kew Index*. The Common Spruce.

SYNONYMS:—*Abies excelsa*, DC. *Flore Française*, 1805 (erroneously marked 1815 in some copies); Poiret (1804); Veitch, 69; Loudon, *Encycl.* 1028, f. 1923; *Pinet. Brit.* ii. 135, t. 19. *Abies Picea*, Miller. *Pinus Abies*, Linn. *Picea vulgaris*, Link. *Pinus excelsus*, Lamarck (1778).

Numerous varieties are in cultivation, for full lists of which see Veitch and Beissner, the latter of whom cites 59 forms. The most remarkable are the dwarf forms like CLANBRASSILLIANA and the long snake-like branched forms such as VIMINALIS, CRANSTONI, and MONSTROSA. Among others may be mentioned—FINEDONENSIS, FENNICA, GIGANTEA, GREGORYANA, INVERTA, ELEGANS, LEMONIANA, MEDIOXIMA, MINIATA, MINOR, MONTANA, MUCRONATA, PARVULA, PYGMÆA, VIMINALIS, SUBARCTICA, CHLOROCARPA, CINEREA, EREMITA, ERYTHROCARPA,

and *EXTREMA*. *ABIES MEDIOXIMA* of Nylander is an arctic form figured in *Pinet. Britan.* ii. 159. *A. EXCELSA CARPATICA* is figured in the same work, vol. ii. 137, t. 20.

Mountains of Northern and Central Europe.

7. *P. Glehnii*, F. Schmidt ; Beissner, 377 ; Mayr, *Mon. Abiet. Japan.* 56, t. 4, f. 11 ; Masters in *Gard. Chron.* March 6, 1880, p. 300, c. ic. ; and in *Journ. Linn. Soc.* xviii. 513, f. 13.

SYNONYMS:—*Abies Glehnii*, Veitch, 80.

Island of Sachalin.

P. grandis. See *Abies grandis*.

8. *P. hondoensis*, Mayr, *Mon. Abiet. Japan.* tab. 4, f. 9. ? = *P. ajanensis*.

Japan.

P. Jezoensis, Sieb. et Zucc. See *P. ajanensis*.

P. laxa, Sargent. See *Picea alba*.

P. Mariana. See *Picea nigra*.

P. magnifica. See *Abies magnifica*.

9. *P. Maximowiczii*, Regel ; Masters in *Gard. Chron.* March 20, 1880, p. 363, fig.

SYNONYMS:—*Abies Maximowiczii*, hort. ; Veitch, 80. *Picea obovata japonica*, Maximowicz *vide* Beissner, p. 370.

Japan. Only known in this country in an undeveloped condition. See under *P. obovata*.

P. Menziesii, Carrière. See *P. sitchensis*, Carrière.

10. *P. Morinda*, Link ; Beissner, 373 ; Masters in *Gard. Chron.* Sept. 26, 1885, fig. 85, p. 393.

SYNONYMS:—*Pinus Smithiana*, Lambert ; Parlatore, 416 ; *Gard. Chron.* 1878, p. 789. *Picea Smithiana*, Boissier, *Flor. Orient.* v. 700, *Abies Khutrow*, Loudon, *Encycl.* 1032, f. 1931. *Pinus Khutrow*, Royle. *Abies Smithiana*, Forbes ; Veitch, 78.

Himalayas from West to East, at elevations of from 8,000–11,000 feet. Introduced in 1818.

11. *P. nigra*, Link ; Engelmann in *Gard. Chron.* 1879, 334 ; Beissner 332, fig. ; Macoun, 468. Black Spruce.

SYNONYMS:—*Pinus Mariana*, Du Roi (1771). *Abies Mariana*, Miller (1759) ; Koch, *Dendrol.* ii. 242. *Abies nigra*, Michaux ; Loudon, *Encycl.* 1031, f. 1929 ; *Arboretum*, fig. 2225 ; Veitch, 74. *Abies denticulata*, Poiret (1804). *Picea rubra*, Link ; Beissner, 338, fig. *Pinus nigra*, Lambert, *Pinus*, ed. i. t. 47 ; Parlatore, 413. *Pinus rubra*, Lambert, ed. i. t. 28, not of Michaux ; Parlatore, 413. *Abies rubra*, Forbes, *Pinetum Woburnense*, t. 35 ; Loudon, *Encycl.* 1032, f. 1930.

For varieties see Beissner l.c.

Canada and North-east America to Carolina.

See also *Abies nobilis*

12. *P. obovata*, Ledebour; Beissner, 368.

SYNONYM:—*Abies obovata*, Loudon, *Arboretum*, iv. 2329; *Encycl.* 1029, 1926; Veitch, 80. *P. Maximowiczii* of gardens (see ante), a dwarf form, is referred by Maximowicz to this species.

VARIETIES:—1 *JAPONICA*, Maximowicz, *Index Sem. Petrop.* 1866, p. 3. *SCHRENKIANA*, Masters in *Journ. Linn. Soc.* 506. *ABIES SCHRENKIANA*, Lindl. et Gordon. *PICEA SCHRENKIANA*, Fischer and Meyer; Beissner, 371.

North-east Europe and Northern Asia. By some considered a form of *Picea excelsa*.

13. *P. Omorica*, Panic; Beissner, 383, fig.; Willkomm, *Forstliche Flora*, 100, figs. 1-12; Masters in *Gard. Chron.* 1877, p. 620, and March 8, 1884, p. 308, fig.; and in *Journ. Linn. Soc.* xxii. 203, fig. Wettstein, *Sitzungsber. d. Kais. Acad. d. Wissensch. Wien*, Bd. xclx. p. 503, c. ic. (§ *OMORICA*.)

SYNONYM:—*Pinus Omorica*, Panic. *Gard. Chron.* April 14, 1877, p. 470.

Mountains of Servia.

14. *P. orientalis*, Carrière; Beissner, 347, fig.; Masters in *Gard. Chron.* March 13, 1886, p. 333, fig., and June 16, 1886, p. 754, fig. male fl.; Boissier, *Flora Orientalis*, vi. 701.

SYNONYMS:—*Abies orientalis*, Poiret; Veitch, 76; Loudon, *Encycl.* 1029, f. 1925; *Pinet. Britan.* ii. 163, t. 23. *Pinus orientalis*, Linn.; Parlatores. *Abies Wittmanniana*, hort. fide Beissner.

VARIETIES:—*PYGMÆA* and *AUREA*.

Mountains of the Taurus and Caucasus. Introduced in 1839.

15. *P. polita*, Carrière; Beissner, 380, with fig. from *Gard. Chron.* 1880, p. 233; Mayr, *Mon. Abiet. Japan.* (1890), p. 46, t. 3, f. 7; Masters, *Journ. Linn. Soc.* xviii. tab. xix.; in *Gard. Chron.* Feb. 21, 1880, p. 233, fig.

SYNONYMS:—*Abies Torano*, Siebold. *A. polita*, Siebold and Zuccarini, *Flor. Jap.* ii. p. 20; Veitch, 77, figs. 9-10.

Mountains of Japan.

16. *P. pungens*, Engelmann in *Gard. Chron.* 1879, 334; 1882, 145; Masters in *Gard. Chron.* 1883, 725, f. 130, and Nov. 7, 1891, pp. 547, 549, fig. cone; Beissner, 347.

SYNONYMS:—*Picea Parryana commutata* of gardens, *Abies Menziesii*, Engelmann partly. *Picea Menziesii*, not of Carrière. *Abies* or *Picea Engelmanni* of gardens, not of Engelmann.

VARIETIES:—*GLAUCA*, and specially *ARGENTEA*, hort., A. Waterer, are the most beautiful of the silver variegated kinds.

Mountains of Wyoming, Utah, and California, 6,000-9,000 feet.

P. rubra, Link. Red Spruce = *Abies rubra*. *Abies arctica*, Cunn. ex *Kew Index*. Arctic America. Introduced in 1755. A dwarf form of *Picea nigra*, which see,

17. *P. sitchensis*, Carrière, *Traité*, i. 260; Engelmann in *Gard. Chron.* 1879, 344; Beissner, 390, fig.; Lemmon, *Third Report*, 115, fig. 3; Macoun, 470. (§ OMORICA.)

SYNONYMS:—*Pinus sitchensis*, Bongard. *Abies Menziesii*, Lindley; Loudon, *Arboretum*, iv. f. 2232; *Encycl.* f. 1934; Forbes, *Pinet. Woburn*, t. 32; Veitch, 73. *Pinus Menziesii*, Douglas; Parlatores, 418; Masters in *Gard. Chron.* June 5, 1886, p. 728, figs. male and female cones. *Abies sitchensis*, Lindley and Gordon.

Alaska to California, on low ground near the coast.

Pine = *Pinus*.

Austrian Pine. See *P. austriaca*.

Bhotan Pine. See *P. excelsa*.

Cluster Pine. See *P. Pinaster*.

Corsican Pine. See *P. Laricio*.

Labrador Pine. See *P. Banksiana*.

Lace-Bark Pine. See *P. Bungeana*.

Pitch Pine. See *P. australis*.

Scotch Pine. See *P. silvestris*.

Stone Pine. See *P. Pinea*.

Sugar Pine. See *P. Lambertiana*.

Umbrella Pine. See *Sciadopitys verticillata*.

Weymouth Pine. See *P. Strobis*.

PINUS, Linnæus, partly; Bentham and Hooker, *Genera Plantarum*, iii. 438; Parlatores in *DG Prod.* xvi. 2, p. 378, partly; Engelmann, *Revis. Genus Pinus*, in *Trans. Acad. St. Louis*, iv. 161; Eichler, *Pflanzenfamilien*, ii. 69, fig. (Tribe ABIETINÆ.)

True Pines are evergreen trees, with the adult leaves persistent, in tufts of 2, 3 or 5; the flowers are monœcious, males in catkins; pollen-cells winged; cones ripening in the second year, woody; scales (relatively) thin at the tips in § *Strobis* and § *Cembra*, thick in § *Pinaster*. Wing of the seed ultimately separable, dilated above, prolonged below into two claw-like processes which clip the edges of the seed. Cotyledons variable in number, 3-sided, usually entire, whilst the primordial leaves are denticulate.

The genus *Pinus*, as here understood, is homogeneous and easily recognisable. Parlatores and some others, however, include under this head all the genera of Abietinæ, viz., *Pinus*, *Abies*, *Picea*, *Larix*, *Cedrus*, *Keteleeria*, *Pseudotsuga*, *Pseudolarix*, *Tsuga*—an inconvenient arrangement.

P. abasica. See *P. halepensis*.

P. Abies. See *Abies pectinata*.

P. aculeensis, Roetzl. See *P. Hartwegii*.

P. adunca. See *P. insignis*.

P. africana. See *P. Pinea*.

1. *P. albicaulis*, Engelmann; Sargent, *Census Report*; *Pinetum Britan.* i. f. 1-4; Beissner, 275; Lemmon, *Second Report*, tab. 4; Macoun, 465; J. D. Hooker in *Gard. Chron.* July 4, 1885, p. 9.

SYNONYMS:—*P. flexilis*, Murray; Parlature, l. c. 403, partly. *P. cembroides*, Newberry, not Zuccarini. *P. Shasta*, Carrière. *P. flexilis* var. *albicaulis*, Engelmann in *Bot. Calif.* ii. 124; Veitch.

P. alopecuroides. See *P. serotina*.

P. altaica, Ledeb. See *P. silvestris*.

P. altissima. See *P. Laricio*.

P. amecaensis, Roehl. See *P. Hartwegii*.

P. americana. See *Tsuga canadensis*.

P. angulata, Roehl. See *P. Montezumæ*.

P. Antioineana. See *P. pseudostrobus*.

2. *P. apulcensis*, Lindl. in *Bot. Reg.* 1839, n. 100; Loudon, *Encycl. Trees*, p. 1014, f. 1899; Gordon, ed. 2, 290.

Introduced from mountains of Mexico by Hartweg in 1839 for the Royal Horticultural Society.

P. Araragi, Sieb. See *Tsuga Sieboldii*.

P. araucana. See *Araucaria imbricata* and *P. Pinea*.

P. aristata, Engelm. See *P. Balfouriana*.

3. *P. arizonica*, Engelmann in *Wheeler's Report*, vi. 260; and in *Gard. Chron.* 1882, xvii. 260; Beissner, 260; Sargent, *Census Report*, 192.

Mountains of Arizona.

P. astecaensis, Roehl. See *P. apulcensis* and *P. Montezumæ*.

P. attenuata, Lemmon. See *P. tuberculata*.

P. atrovirens. See *P. Hartwegii*.

P. australis, Michaux; Parlature, 392. Pitch Pine. See *P. palustris*, Miller; Lambert.

P. austriaca. See *P. Laricio*.

4. *P. Ayacahuite*, Ehrenberg; Parlature, 407; *Pinetum Britan.* vol. i. p. 9, tab. 2; Masters in *Gard. Chron.* October 14, 1882, p. 493; Loudon, *Encycl.* 1023, f. 1920, etc.

SYNONYM:—*P. strobiliformis*, Engelmann. With six synonyms of Roehl, referred to in this list under their alphabetical order.

Mexico, Guatemala. Introduced from Mexico by Hartweg.

P. Backhouseana. See *P. Montezumæ*.

5. *P. Balfouriana*, Murray; Sargent, *Census Report*, 191; *Pinet. Brit.* i. 11, f. 1-5; Veitch, 175; Beissner, 272; Lemmon, *Second Report*, t. 5; *Gard. Chron.* 1876, March 11, p. 332.

VARIETY:—*ARISTATA*, Engelmann. = *P. Balfouriana*, Watson, not Murray. *Gard. Chron.* Oct. 30, 1875, p. 349.

California, mountains in Siskiyou County.

6. *P. Banksiana*, Lambert, ed. 1, p. 7 (1803); Veitch, 158; Beissner, 218; Forbes, *Pinet. Woburn*. t. 3; Loudon, *Arboretum*, iv. f. 2064; *Encycl. f.* 1798; Macoun, 468.

SYNONYM.—*P. hudsonica*, Poiret (1804); Parlatore, 380.

North-Eastern United States and eastern slopes of Rocky Mountains.

P. Beardsleyi. See *P. ponderosa*.

P. Benthamiana. See *P. ponderosa*.

P. Besseriana. See *P. Teocote*.

P. Bolanderii, Parlatore, l. c. 379. See *P. contorta*.

P. Boothiana, Roehl. See *P. Montezumæ*.

P. Bouchcana, Roehl. See *P. Montezumæ*.

P. Boursierii, Carr. See *P. contorta*.

P. brachyptera. See *P. ponderosa*.

P. Brutia. See *P. pyrenaica*.

P. bullata. See *P. Montezumæ*.

7. *P. Bungeana*, Zuccarini; Parlatore, l. c. 398; *Pinet. Britan.* i. 13; Masters in *Gard. Chron.* 1882, July 1, p. 8; Veitch, 161; Beissner, 252.

Introduced by Fortune from North China in 1846.

P. Buonaparteæ, Roehl; Gordon, ed. ii. 295. See *P. Ayacahuite*.

P. cairica. See *P. halepensis*.

P. californiana, Loiseleur. See *P. insignis* and *tuberculata*.

Loiseleur's description "is so unsatisfactory and faulty that it is impossible to recognise absolutely from it the species he intended. Under these circumstances the only safe way is to pass over Loiseleur's name entirely."—Sargent, *Garden and Forest*, p. 65 (1892).

P. calabrica. See *P. Laricio*.

8. *P. canariensis*, Ch. Smith; Parlatore in *DC. Prod.* xvi. 2, 393; Loudon, *Encycl. f.* 1862; Lambert, *Pinus*, ed. 3, vol. i. t. 28; Webb and Berthelot, *Phyt. Canar.* iii. 280, t. 6; Masters in *Gard. Chron.* 1888, June 9, p. 723, fig.; Veitch; Beissner, 251.

Canary Islands. Grown in conservatories.

P. caramana. See *P. Laricio*.

P. carica, Don. See *P. halepensis*.

P. carpatia, hort. See *P. Pumilio (montana)*.

P. Carrieri, hort. See *P. Montezumæ*.

P. caucasica, Fisch. See *P. silvestris*.

P. Cavendishiana, hort. See *P. Khasya* and *P. sinensis (Massoniana)*.

P. cebemensis. See *P. Laricio*.

9. *P. Cembra*, Linnæus; Parlatore, 402; Lambert, *Pinus*, ed. 2, t. 23; Veitch, 176; Beissner, 277, fig.; Loudon, *Encycl. Trees*, 1017, f. 1904; *Pinet. Brit.* i. p. 17, t. 3.; *Gard. Chron.* 1872, p. 397.

VARIETY.—*PUMILA* = *P. Cembra pumila*, Pallas, *Flor. Ross.* p. 5, t. 2.

P. pumila, Mayr; *Mon. Abiet. Japan.* (1890), 80, t. 6, f. 21.
P. mandschurica, Regel. *Pinet. Brit.* i. p. 61.

Mountains of Central Europe, Siberia; var. *pumila* in Kamtschatka and the Kurile Islands.

10. *P. cembroides*, Zuccarini; Parlatores, l. c. 397; Gordon in *Journ. Hort. Soc.* i. 236, figure. ? of Zuccarini.

SYNONYMS:—*P. Llaveana*, Schiede and Deppe ex Parlatores; Loudon, *Encycl. f.* 1858. *P. osteosperma*, Engelmann; Lindley and Gordon, *Journ. Hort. Soc.* v. 216; Beissner, 253.

Arizona.

P. Chalmensis, Roehl. See *P. Montezumæ*.

11. *P. Chihuahuana*, Engelmann; Parlatores, l. c. 397; Hoopes, *Evergreens*, 143; Beissner, 258.

Mountains of New Mexico and Arizona.

P. chinensis, Knight. See *P. Pinaster*.

P. chylla. See *P. excelsa*.

P. clamaensis. See *P. Hartwegii*.

12. *P. clausa*, Vasey; Sargent, *Census Report*, 199; Mayr, *Waldung von Nord-Amerika*; Beissner, 216; Sudworth in *Garden and Forest*, April 6, 1892, fig. 24.

SYNONYM:—*P. inops* var. *clausa*, Engelmann.

Florida.

P. coarctata. See *P. Montezumæ*.

P. colchica. See *P. halepensis*.

P. colorado. See *P. Ayacahuite*.

13. *P. contorta*, Douglas in Loudon, *Encycl. Trees*, 975, f. 1815; Loudon, *Arboretum*, figs. 2210-11; Parlatores, 381, partly; Beissner, 219; Veitch, 145; Masters in *Gard. Chron.* 1883, 45, f. 5; Macoun, 466; Lemmon, *Second Report*, t. 9.

SYNONYMS:—*P. Boursieri*, Carrière, *Rev. Hort.* 1884, p. 223, with fig. *P. Bolanderii*, Parlatores, 379.

VARIETIES:—MURRAYANA, Balfour, *Oregon Exp.* t. 3. *P. MURRAYANA*, Lemmon, *Second Report*, t. 10.

North-west America; Alaska to California, along the coast. Var. *MURRAYANA* in the valleys of the interior.

P. cornea, Roehl. See *P. Montezumæ*.

P. corrugata, Roehl. See *P. Hartwegii*.

14. *P. Coulteri*, Don; Parlatores, l. c. 392; Loudon, *Arboretum*, iv. fig. 2144, &c.; *Encycl. f.* 1841, &c.; Forbes, *Pinetum Woburn.* t. 25; Beissner, 257; Lemmon, *Second Report*, t. 13; Masters in *Gard. Chron.* March 28, 1885, p. 415, figs. 73, 74; Dec. 29, 1888, tree at Kew; *Pinet. Brit.* i. 23.

SYNONYMS:—*P. macrocarpa*, Lindley; Veitch, 166. *P. Sabiniana* var. *Coulteri*, Loudon, *Encycl. Pl.* 985, f. 1839.

California.

P. cupressoides. See *Araucaria imbricata*.

15. *P. cubensis*, Grisebach; Parlatores in *DC. Prod.* xvi. 2, 396.

SYNONYMS:—*P. Elliotti*, Engelm. *P. cubensis* var. *terthrocarpa*, Wright in Griseb. *Cat. Pl. Cuba*, 217.

Southern States of North America, Cuba.

P. Decaisneana, Roehl. See *P. Montezumæ*.

P. De Candolleana, Roehl. See *P. leiophylla*.

P. deflexa. See *P. Jeffreyi*.

P. del Doctor. See *P. patula*.

16. *P. densiflora*, Siebold and Zuccarini, *Flor. Jap.* ii. p. 22, t. 112; Murray, *Proc. Hort. Soc.* ii. 286; Masters, *Journ. Linn. Soc.* xviii. 503 (1880); Mayr, *Mon. Abiet. Japan.* 72, tab. 5 (1890); Veitch, 146; Beissner, 247.

Mayr, l. c., p. 90, describes hybrids between this species and *P. Thunbergii*, and also a large number of cultivated varieties not yet introduced.

Japan.

P. dependens, Roehl. See *P. leiophylla*.

P. Devoniana, Roehl. See *P. Montezumæ*.

P. Dicksoniana. See *P. excelsa*.

P. divaricata, hort. See *P. Banksiana*.

P. Doelleriana, Roehl. See *P. Montezumæ*.

P. Dom Pedri, Roehl. See *P. Ayacahuite*.

P. Durangensis, Roehl. See *P. Ayacahuite*.

P. echinata, hort. See *P. mitis* and *P. montana*.

P. Edgariana. See *P. muricata*.

17. *P. edulis*, Engelm. ; Parlatores, l. c. 398; Lindley and Gordon, *Journ. Hort. Soc.* v. 216; Veitch, 172; *Gard. Chron.* 1886 (1) p. 301.

SYNONYM:—*P. cembroides*, Gordon, not of Zuccarini, *vide* Sargent; Lindley and Gordon, *Journ. Hort. Soc.* v. 216.

New Mexico, Colorado, Texas.

P. Ehrenbergii. See *P. Hartwegii* and *P. leiophylla*.

P. Elliottii, Engelm. = *P. cubensis*.

P. Endlicherii, Regel. See *P. Hartwegii*.

P. Engelmannii. See *P. ponderosa*.

P. Erzeroumica. See *P. silvestris*.

P. Escandoniana. See *P. pseudostrobus*.

18. *P. excelsa*, Wallich; Parlatores, 404; Loudon, *Encycl.* 1023, figs.; Hook. *Flora Brit. India*, v. p. 651; Lambert, *Pinus*, ed. 2, t. 26;

Boissier, *Fl. Orient.* v. 698; Masters in *Gard. Chron.* Feb. 24, 1883, f. 35; Veitch, 177; Beissner, 283; *Pinet. Brit.* 27, t. 4.

The Greek plant known as *P. peuke*, referred by Hooker to this species, is abundantly distinct in cultivation.

Temperate Himalaya.

P. excorticata, Lindl. et Gord. See *P. Bungeana*.

P. exserta, Roezl. See *P. pseudostrobus*.

P. Fenzlii. See *P. Laricio*.

P. fertilis. See *P. cembroides*.

19. *P. filifolia*, Lindley in *Bot. Reg.* 1840; Parlatores, 400; Loudon, *Encycl.* p. 1008, figs. 1889-90, from Hartweg's type; Gordon, ed. 2, 301.

Introduced to the Royal Horticultural Society in 1839 from the volcano of Fuego, Guatemala, by Hartweg.

P. Fischeri. See *P. montana*.

20. *P. flexilis*, James; Parlatores, 403; Veitch, 177; Beissner, 273; Macoun, 465; *Pinet. Brit.* i. 33; *Gard. Chron.* Sept. 18, 1875, p. 356, fig. 75.

SYNONYMS:—*P. Lambertiana* β , Hook. *P. Lambertiana* var. *brevifolia*, Lindley and Gordon.

Eastern slope of Rocky Mountains, Montana to New Mexico, Texas, Utah, Nevada, Arizona (Sargent).

P. fragilis. See *P. Pinea*.

P. Fraserii. See *P. rigida*.

P. Fremontiana. See *P. monophylla*.

P. frondosa, Roezl. See *P. Hartwegii*.

P. galocote, Roezl. See *P. Teocote*.

P. Geitnerii, Roezl. See *P. Hartwegii*.

P. genevensis, hort. See *P. silvestris*.

P. genuensis, Loddige. See *P. halepensis*.

P. georgica, hort. See *P. palustris*.

21. *P. Gerardiana*, Wallich; Lambert, *Pinus*, ed. 3, t. 79; Parlatores, l. c. 391; Loudon, *Encycl.* f. 1869, etc.; J. D. Hook. *Flor. Brit. Ind.* v. 652; Royle, *Ill.* 353, t. 85; Veitch, 163; Beissner, 251; Boissier, *Flor. Orient.* v. 696.

North-Western Himalaya. Scarcely hardy.

P. Ghiesbreghtii, Carrière, ed. 2, 426. Unknown except by the brief mention by Carrière, who says it is a 5-leaved species.

22. *P. glabra*, Walter; Sargent, *Census Report*, 200; Hoopes, *Evergreens*, 82.

South Carolina, Florida.

P. Gordoniana. See *P. Montezumæ*.

P. gracilis, Roezl. See *P. leiophylla*.

P. grandis, Roezl. See *P. Montezumæ*.

23. *P. Greggii*, Engelmann; Parlatore, l. c. 396.

Said to be of Mexican origin; not in cultivation.

P. Grenvilleæ. See *P. Montezumæ*.

P. Haageana, Roehl. See *P. Montezumæ*.

P. hagenoviensis. See *P. silvestris*.

24. *P. halepensis*, Miller; Parlatore, l. c. 383; Lambert, *Pinus*, ed. 2, p. 14, t. 7; Veitch, 146; *Gard. Chron.* Nov. 1, 1884, p. 553, f. 97, and May 19, 1888, p. 629, catkins; Boissier, *Fl. Orient.* v. 695; Beissner, 223; Loudon, *Encycl.* f. 1792.

SYNONYMS:—*P. maritima*, Lambert, *Pinus*, ed. 2, p. 13, t. 6.

P. Pithyusa, Strangeways. *P. Abschasica*, Fischer = *abasica*, Carrière.

Count Saporta mentions a hybrid between *P. halepensis* and *P. Pinaster*. See Beissner, 224.

Mediterranean, Caucasus, Levant, Afghanistan.

P. hamata, Roehl. See *P. Ayacahuite*.

P. Hamiltonii. See *P. Pinaster*.

25. *P. Hartwegii*, Lindley; Parlatore, l. c. 339; Loudon, *Encycl.* f. 1875. Gordon, ed. 2, 304.

SYNONYMS:—*P. Ehrenbergii*, Endlicher. *P. rudis*, Endlicher. *P. Montezumæ*, Gordon. Some twenty synonyms are given by Roehl in his Catalogue of Mexican Seeds.

Mountains of Mexico, 9,000–14,000 feet.

P. Heldreichii. See *P. Laricio*; also *P. leucodermis*.

P. helenica, hort. See *P. Pinaster*.

P. Hendersonii, Roehl. See *P. Montezumæ*.

P. heteromorpha, Roehl. See *P. pseudostrobus*.

P. hierosolimitana. See *P. halepensis*.

P. hispanica. See *P. pyrenaica*.

P. hispanica, *Gard. Chron.* 1841, 564.

P. horizontalis, Roehl. See *P. Montezumæ*.

P. hudsonica, Poiret ex Parlatore, 380 (1804) = *P. Banksiana*, Lambert (1828).

P. Hügelii, Roehl. See *P. Teocote*.

P. huisquilocænsis. See *P. leiophylla*.

P. humistrata, Carr. See *P. Cembra*.

26. *P. inops*, Solander; Parlatore, l. c. 380; Lambert, *Pinus*, ed. 1, t. 13; Loudon, *Arboretum*, fig. 2068; *Encycl.* f. 1802; *Pinet. Woburn.* t. 4; Veitch, 158; Beissner, 215.

SYNONYMS:—*P. virginiana*, Miller ex Parl. *P. variabilis*, Lambert, ed. 1, p. 22, t. 15, ex Parl. See *P. mitis*.

VARIETY:—*CLAUSA*. See *P. clausa*.

North-Eastern United States. Height 40–50 feet.

27. *P. insignis*, Douglas; Parlatore in part, l. c. 395; Loudon, *Arboretum*, iv. f. 2132, etc.; *Encycl.* f. 1848; *Pinet. Woburn.* t. 18;

Pinet. Brit. i. 37, t. 5, f. 1-14; Veitch, 163; Beissner, 271, fig.; Masters in *Gard. Chron.* 1878, p. 108; March 14, 1891, p. 341, cone, &c.; Lemmon, *Second Report*, tab. 16.

SYNONYMS:—*P. radiata*, Don; Loudon, *Arboretum*, iv. fig. 2182; Gordon in *Journ. Hort. Soc.* iv. 214, figure. *P. tuberculata*, Don; Loudon, *Arboretum*, fig. 2181, not of Gordon.

VARIETY:—*BINATA*, leaves in pairs, Engelmann, Sargent. California.

It has recently been proposed to call this *P. tuberculata*, but for garden purposes it seems better to continue to call it *P. insignis*.

P. interposita, Roezl. See *P. Teocote*.

P. Iztacihuatlii, Roezl. See *P. Hartwegii*.

P. japonica, Pinet. Woburn. p. 33=? *P. Massoniana*.

P. japonica, hort. ex Carr. *P. Pinaster*.

28. *P. Jeffreyi*, Murray; *Oregon Comm.* p. 2, tab. 1; *Garden and Forest*, Sept. 30, 1891; Parlatore, l. c. 393; *Pinet. Brit.* i. 45, t. 6; Beissner, 263; Veitch, 165; Masters in *Gard. Chron.* March 23, 1889, p. 361; Lemmon, *Second Report*, t. 12; Hooker in *Gard. Chron.* Dec. 27, 1884, p. 814, fig. 141.

SYNONYM:—*P. deflexa*, Torrey, *Gard. Chron.* 1875, 106.

Introduced from California in 1852 by Jeffrey.

P. Jostii, Roezl. See *P. filifolia*.

P. Keteleerii, Roezl. See *P. Montezumæ*.

29. *P. Khasya*, Royle ex Parlatore, l. c. 390; Hooker, *Flor. Brit. India*, vol. v. 654.

SYNONYM:—*P. Cavendishiana*, hort. ex Parlatore.

Nepal.

P. Krelagei, Roezl. See *P. Hartwegii*.

P. Kochiana, Klotzsch; Koch, *Dendrol.* ii. 280. See *P. silvestris*.

30. *P. koraiensis*, Siebold and Zuccarini, *Flor. Japan*, ii. p. 28, t. 116; Murray, *Pines and Firs of Japan* (1863); Veitch, 179; Beissner, 281, fig.; Mayr, *Mon. Abiet. Japan.* 73, t. 5 (1890); Masters, *Journ. Linn. Soc.* xviii. 504 (1880). For varieties see Mayr, l. c. 94.

Korea, Kamschatka, Japan (cult.). Introduced by Mr. John Veitch in 1861.

31. *P. Lambertiana*, Douglas; Parlatore, 406; Forbes, *Pinetum Woburn.* t. 30; *Pinetum Britan.* i. 47, t. 7; Loudon, *Encycl.* figs. 1909-12; Hoopes, *Evergreens*, 134; Veitch, 179; Beissner, 295; Lemmon, *Second Report*, tab. 2; Hooker in *Gard. Chron.* Jan. 1, 1885, p. 11; Masters in *Gard. Chron.* June 11, 1887, p. 769, f. 144, male fl. The Sugar Pine.

32. *P. Laricio*, Poiret; Parlature, l. c. 386; *Pinet. Britan.* i. 55, t. 8; Lambert, *Pinus*, ed. 2, p. 9, t. 4; Beissner, 238, fig.; Veitch, 147; *Gard. Chron.* Jan. 5, 1884, p. 15, fig.; Boissier, *Flor. Orient.* v. 696; Loudon, *Encycl.* f. 1769. *Gard. Chron.* Dec. 15, 1888, p. 693, tree at Kew, and fig. 99, p. 705, cone, &c.

SYNONYMS:—*P. Laricio* var. *Poiretiana*, Antoine. *P. Laricio*, β *latisquama*, Willkomm. *P. maritima*, Aiton, *Hort. Kew.* ed. 2, vol. v. p. 315; Koch, *Dendrol.* ii. 287.

VARIETIES:—*MARITIMA*, Pallas. *PINEA*, Hablitz. *HALEPENSIS*, Marschal. v. Bieberstein. *LARICIO*, *ejusdem.* *PALLASIANA*, Lambert, *Pinus*, ed. ii. p. 11, t. 5; Carrière and others; Loudon, *Encycl.* f. 1774; *Gard. Chron.* Dec. 22, 1883, p. 785, fig. 142. *KARAMANA*, Masters in *Gard. Chron.* April 12, 1884, fig. 91; see also Beissner, p. 241.

The above are regarded as typical by Parlature, who groups the very numerous varieties as follows:—

β *TENUIFOLIA*:—Including forms with narrow and thin leaves, such as—*LARICIO* β *PYRENAICA*, Loudon, *Encycl.* f. 1778–1780, and γ *CEBENNENSIS* of Grenier and Godron. *MONSPELIENSIS*, Salzmann. *SALZMANNI*, Dunal. *ANGUSTISQUAMA*, Willkomm. *LEPTOPHYLLA*, Christ.

γ *NIGRICANS*:—Including forms with thicker, stiffer leaves of a brownish-green colour, such as—*P. NIGRICANS*, hort.; Link. *P. AUSTRIACA*, Höss., the name usually adopted in gardens. Figured in *Gard. Chron.* 1878, p. 275, and in Loudon, *Encycl.* f. 1773. *LARICIO AUSTRIACA*, Endlicher. *LARICIO NIGRICANS*, Christ. These four names refer apparently to the same form. *FENZLII*, Kotschy; Carrière. *HELDREICHII*, Christ., *Europ. Abiet.* p. 11; *Gard. Chron.* June 7, 1884, p. 740, fig. 140. *LEUCODERMIS*, Antoine; Beissner, 244. *MAGELLENSIS*, Gussone. *TAURICA*, hort. *DALMATICA*, Visiani.

δ *PALLASIANA*:—Leaves stiff as in var. γ , but with larger cones and the surface of the scales cracked.

Dalmatia, Servia, Thessaly.

33. *P. latifolia*, Mayr in *Garden and Forest*, 1889, p. 496, c. ic.; Beissner, 258.

SYNONYM:—*P. latisquama*, Engel. in *Gard. Chron.* Dec. 2, 1882, p. 713, fig.

P. laxa. See *Picea alba*.

34. *P. leiophylla*, Schiede and Deppe; Parlature, 401; Loudon, *Encycl.* p. 1011, figs. 1891–93.

Ten names given by Roezl in his catalogue are quoted as synonyms by Parlature.

Mountains of Mexico.

P. Lemoniana. See *P. Pinaster*.

P. leucodermis, Antoine; Boissier, *Flor. Orient.* v. 697. See *P. Laricio*.

P. Llaveana. See *P. cembroides*.

P. Loddigesii. See *P. rigida*.

P. Loiseleuriana. See *P. pyrenaica* (Brutia).

35. *P. longifolia*, Roxburgh, *Flora Indica*, iii. 651 ; Parlatore, l. c. 390 ; J. D. Hooker, *Flor. Brit. India*, v. 653 ; Royle, *Ill. Him. Pl.* t. 85, f. 2 ; Madden in *Journ. Hort. Soc.* v. 228 ; Veitch, 172 ; Beissner, 251 ; Loudon, *Encycl.* f. 1868 etc.

Himalaya.

36. *P. lophosperma*, Lindley in *Gard. Chron.* 1860, 46 ; Parlatore, 391.

SYNONYM:—*P. Torreyana*, Parry.

P. Loudoniana. See *P. Ayacahuite*.

P. Lowii, Roehl. See *P. Hartwegii*.

P. lutea, Loddiges. See *P. echinata* ?

P. Macintoshiana. See *P. contorta*.

P. macrocarpa. See *P. Coulterii*.

P. macrophylla. See *P. Montezumæ*.

P. maderensis, Tenore. See *P. Pinea*.

P. magellensis, Journ. Hort. Soc. iii. (1848) 118. See *P. montana* (uncinata).

P. magnifica, Roehl. See *P. Montezumæ*.

P. mandshurica. See *P. Cembra*.

P. maritima, R. Br. See *P. Laricio*.

P. maritima, Lambert. See *P. Pinaster* and *P. halepensis*.

P. marylandica. See *Picea nigra*.

37. *P. Massoniana*, Lambert, *Pinus*, ed. 2, p. 16, t. 8 ; Parlatore, 389 ; Beissner, 249. Not of gardens generally.

SYNONYM:—*P. sinensis*, Lambert, ed. 3, 47.

China.

P. Massoniana, Sieb. et Zucc. *Fl. Jap.* ii. t. 113, 114 (not of Lambert nor of gardens), = *P. Thunbergii*.

P. Massoniana, hort. = *P. densiflora*, partly.

P. michocaensis, Roehl. See *P. Montezumæ*.

P. microcarpa. See *P. Teocote*.

P. minor, hort. See *P. halepensis*.

38. *P. mitis*, Michaux ; Parlatore, l. c. 380 ; Beissner, 216 ; Loudon, *Arboretum*, fig. 2072 et seq. ; *Encycl.* t. 1811 ; *Pinet. Woburn.* t. 11.

SYNONYMS:—*P. variabilis*, Pursh. *P. echinata*, Miller. *P. Tæda* var. *variabilis*, Aiton.

P. variabilis of Lambert is referred by Parlatore to *P. inops* ;

P. variabilis of Pursh, and Loudon, *Encycl.* fig. 1828, to *P. mitis*.

Eastern United States to Florida and Texas.

39. *P. monophylla*, Torrey and Fremont ex Parlature, l. c. 378; *Pinet. Brit.* i. 65, t. 9; Veitch, 150; Beissner, 254; Masters in Balfour, *Annals of Botany*, ii. p. 124, and in *Gard. Chron.* 1883, p. 48, f. 8.; Hooker in *Gard. Chron.* July 31, 1886, p. 137.

SYNONYMS:—*P. Fremontiana*, Endlicher; Gordon in *Journ. Hort. Soc.* iv. 293, figure; *Pinetum Brit.* i. 65, t. 9, f. 1-12.

Sierra Nevada, Utah.

P. monophylla, hort. See *P. silvestris*.

P. monspeliensis. See *P. Pinaster*.

P. monstrosa, Roezl. See *P. Montezumæ*.

40. *P. montana*, Duroi (1771); Parlature, l. c. 386; Christ. *Europ. Abiet.* p. 11; Beissner, 233.

SYNONYMS:—*P. silvestris* γ *montana*, Aiton, *Hort. Kew.* *P. Mugho*, Poir. *P. Pumilio*, Haencke; Loudon, *Encycl.* f. 1764. *P. Mughus*, Scopoli. *P. sanguinea*, Lapeyrouse. *P. uncinata*, Ram.; Loudon, *Encycl.* fig. 1767 (as *Mughus*); *Gard. Chron.* August 16, 1884, p. 209.

VARIETIES:—*OBLIQUA*, Sauter. *HUMILIS*, Link. *ROTUNDATA*, Link. *ULIGINOSA*, Wimmel. *MAGELLENSIS*, Schouw.

For other varieties see Beissner, l. c. p. 234, who arranges them under the three heads of "*UNCINATA*," "*PUMILIO*," and "*MUGHUS*."

Height 30-60 feet. Subalpine districts of Central and Southern Europe.

P. monte allegri, Roezl. See *P. leiophylla*.

P. montereyensis. See *P. insignis*.

41. *P. Montezumæ*, Lambert; Gordon in *Journ. Hort. Soc.* vol. ii. 1846, p. 235, fig.; *Pinus*, ed. i. t. 64; Parlature, l. c. 398; Masters in *Gard. Chron.* Oct. 25, 1890, p. 466, figs. 90-94; Loudon, *Encycl.* f. 1884.

SYNONYMS:—*P. occidentalis*, Humboldt, Bonpland, and Kunth. *P. Devoniana*, Spach; Loudon, *Encycl.* f. 1877, 1878. *P. Russelliana*, Lindley; Loudon, *Encycl.* f. 1879. *P. pseudostrobus*, Gordon. Other synonyms are entered in their alphabetical sequence.

In addition to the above synonyms some fifty were launched by Roezl in his "*Catalogue des Graines des Conifères de Mexique*!" and which are all placed under this species by Parlature, who groups the several varieties known to him under the following headings:—

VARIETIES:— β . *MACROPHYLLA*, with long leaves = *PINUS MACROPHYLLA*, Lindley; Loudon, *Encycl.* f. 1885. *P. WINCESTERIANA*, Gordon, *Journ. Hort. Soc.* ii. 241. *P. GRENVILLEÆ*, Gordon in *Journ. Hort. Soc.* ii. 77, fig.; *Gard. Chron.* Jan. 22, 1881, p. 113. *P. GORDONIANA*, Hartweg in *Journ. Hort. Soc.* ii. p. 79, fig.

γ *LINDLEYANA*, with shorter leaves and smaller cones: *P. LINDLEYANA*, Gordon in *Journ. Hort. Soc.* v. 215; Loudon, *Encycl.* f. 1883.

A most variable species, native of the mountains of Mexico.

42. *P. monticola*, Douglas ; Parlatores, 405 ; Loudon, *Arboretum*, iv. 2291, figs. 2208-9 ; *Encycl. Trees*, 1021, f. 1913, &c. ; *Pinetum Brit.* i. 69, f. 1-6 ; Veitch, 181, fig. ; Beissner, 293 ; Lemmon, *Second Report*, tab. 1 ; Macoun, 465.

VARIETY :—PORPHYROCARPA = *P. PORPHYROCARPA*, Murray in *Pinet. Brit.* i. figs. Differs in its purple cones and broader leaves.

Discovered and introduced by Douglas.

Vancouver's Island, British Columbia, Oregon to California. Altitude 3,000-10,000 feet.

P. Mugho. See *P. montana* (Pumilio).

P. Mulleriana. See *P. Teocote*.

43. *P. muricata*, Don ; Parlatores, l. c. 379 ; Gordon in *Journ. Hort. Soc.* iv. 216, fig. ; Loudon, *Arboretum*, f. 2180 ; *Encycl.* f. 1849 ; Veitch, 151 ; Masters in *Gard. Chron.* Jan. 12, 1884, p. 49, figs. 7-9 ; Beissner, 213.

SYNONYM :—*P. Edgariana*, Hartweg in *Journ. Hort. Soc.* iii. pp. 217, 226.

California.

P. Murrayana. See *P. muricata*.

P. neglecta, Low. See *P. Pinaster* and *P. Laricio* var. *karamana*.

P. neosa. See *P. Gerardiana*.

P. nepalensis, Pinet. Woburn., is probably *P. Pinaster*, introduced into the Residency Garden in Nepal (Hooker). See also *P. excelsa*.

P. ne plus ultra, Roezl. See *P. Montezumæ*.

P. Nesselrodiana, Roezl. See *P. Montezumæ*.

P. nitida, Roezl. See *P. Montezumæ*.

P. nivea, Booth. See *P. Strobilus* and *P. monticola*.

P. Northumberlandiana, Roezl. See *P. Montezumæ*.

P. Novæ-Hollandica. See *P. Pinaster*.

P. Novo-Zelandiæ. See *P. Pinaster*.

P. nummularia, Gordon ?

P. Ocampii, Roezl. See *P. Montezumæ*.

P. ocote, Roezl. See *P. Montezumæ*.

P. ocotechino, Roezl. See *P. leiophylla*.

44. *P. occidentalis*, Swartz ; Parlatores, 402 ; Loudon, *Encycl. Trees*, p. 1015, f. 1901.

Cuba, St. Domingo.

45. *P. oocarpa*, Schiede ; Parlatores, 401 ; Loudon, *Encycl.* p. 1013, figs. 1894-97.

SYNONYMS :—*P. oocarpoides*, Gordon, ed. 2, 316. *Pinus Skinneri*, hort., fide Carrière.

Introduced by Hartweg from Mexico. Occurs also in Guatemala.

P. orientalis, Friv. See *Picea excelsa*.

P. Orizabæ. See *P. pseudostrobus*.

P. Ortigiesiana, Roehl. See *P. Montezumæ*.

P. osteosperma. See *P. cembroides*.

P. Otteana, Roehl. See *P. Teocote*.

P. Padufla. See *P. silvestris*.

P. Pallasiana. See *P. Laricio*.

P. palmiensis, or *Palmierii*. See *P. palustris*.

46. *P. palustris*, Miller (1759); Lambert, *Pinus*, ed. 1, t. 20; Forbes, *Pinet. Woburn*, t. 22.

SYNONYM:—*P. australis*, Michaux, *Hist. Arb. Am.* i. 64, t. 6 (1810); Loudon, *Arboretum*, f. 2156, &c.; *Encycl.* f. 1843; Parlature, 392; Veitch, 172.

Southern States of U.S.A. and Texas.

P. Papelerii, Roehl. See *P. Hartwegi*.

P. Paroliniana, Webb. See *P. Laricio*.

47. *P. Parryana*, Engelmann; Parlature, 402; Gordon, 278; Beissner, 255; Lemmon, *Second Report*, t. 8.

SYNONYM:—*P. Llaveana*, Torrey, not of Schiede and Deppe. See also *P. ponderosa*.

South California.

48. *P. parviflora*, Siebold and Zuccarini, *Flor. Japon.* ii. tab. 115; Murray, *Pines and Firs of Japan*, ii. (1863); Masters in *Gard. Chron.* 1878, p. 624, fig. 103; and in *Journ. Linn. Soc.* xviii. 504; Mayr, *Mon. Abiet. Japan.* (1890), 76, t. 5; Veitch, 183; Beissner, 282.

Introduced from Japan in 1861 by Mr. John Veitch. For varieties not yet introduced see Mayr, l. c. 94.

49. *P. patula*, Schiede and Deppe; Loudon, *Encycl.* f. 1856; Lambert, *Pinus*, ed. 1, t. 61; Parlature, l. c. 397; Masters in *Gard. Chron.* Jan. 24, 1885, p. 109, figs. 19, 20, 22 (tree).

VARIETY:—MACROCARPA, Schiede = *P. del Doctor*. *Gard. Chron.* April 4, 1891, p. 435, fig. 92.

Mexico.

P. Pawlikowskyana, Roehl. See *P. Montezumæ*.

P. Paxtonii, Roehl. See *P. Montezumæ*.

50. *P. pentaphylla*, Mayr, *Mon. Abiet. Japan.* 1890, p. 79, t. 6, f. 20.

Japan.

51. *P. persica*, Strangeways in *Gard. Mag.* 15, 130; ex Parlature, l. c. 391; Boissier, *Fl. Orient.* v. 698.

Imperfectly known. Dr. Stapf informs me that, in his opinion, it

is *P. Brutia* ; but that he never saw a wild pine in South or Central Persia.

Southern Persia. Cultivated ?

52. *P. Peuke*, Grisebach, *Spicil. Flor. Rumel.* ii. p. 349 ; Boissier, *Flor. Orient.* v. 698 ; Velenovsky, *Flora Bulgarica*, 1891.

SYNONYMS:—*P. excelsa*, Hooker, *Journ. Linn. Soc.* viii. 145 ; Masters in *Gard. Chron.* 1883, February 24 ; and in *Journ. Linn. Soc.* xxii. 205, fig. *P. excelsa*, Peuke ; Beissner, 287.

P. Picea, Duroi. See *Picea excelsa*, Link.

53. *P. Pinaster*, Solander ; Parlature, l. c. 383 ; Lambert, *Pinus*, ed. ii. p. 17, t. 9, 10 ; Loudon, *Encycl.* 963, fig. 1782 ; *Pinet. Brit.* i. 71, t. 10 ; Beissner, 221 ; Veitch, 152, excl. syn. *Brutia*. Abnormal growth of, *Gard. Chron.* March 22, 1884.

SYNONYMS:—*P. maritima*, Poiret. *P. Laricio*, Savi. *P. nepalensis*, Royle. *P. Latterii*, Madden. *P. Helenica*, Loudon.

For other synonyms see Parlature, l. c.

VARIETIES:—HAMILTONII, Lindley and Gordon in *Journ. Hort. Soc.* v. 217 ; MINOR, Loudon, *Encycl.* 963, f. 1785 ? = *P. escarena*, Risso ; PROLIFERA, a monstrous form with very numerous small cones in dense clusters ; LEMONIANA. *P. Lemoniana*, Benth. in *Trans. Hort. Soc.* 2 ser. vol. i. 512, t. 20 ; Loudon, *Encycl.* 963, f. 1784. A variety in which the usually lateral and deflexed cones assume an erect position by reason of the non-development of the terminal leaf-bud. I have met with a similar condition twice in *P. silvestris*.

Mountains and sea-coast of Southern Europe, the Levant, &c.

54. *P. Pinceana*, Gordon, ed. 2, 281.

A Mexican Pine, of which little is known.

55. *P. Pinea*, Linnæus ; Parlature, l. c. 381 ; Loudon, *Encycl.* 965, fig. 1787 ; Veitch, 154 ; Beissner, 221 ; Lambert, *Pinus*, ed. 2, vol. i. t. 6-8 ; Masters in *Gard. Chron.* Nov. 24, 1888, p. 604, fig. The Stone Pine, or the Umbrella Pine of Europe.

SYNONYM:—*P. maderensis*, Tenore.

Parlature makes two varieties:—FRAGILIS ; CRETICA.

Mediterranean region, Madeira, Canaries.

P. Pithyusa. See *P. halepensis*.

P. Planchonii. See *P. Montezumæ*.

P. Poiretiana. See *P. Laricio*.

56. *P. ponderosa*, Douglas ; Parlature, l. c. 395 ; Loudon, *Encycl.* f. 1831, imperfect cone ; *Arboretum*, figs. 2132-2136 ; Forbes, *Pinetum Woburn.* t. 15 ; Masters in *Gard. Chron.* Nov. 15, 1890, p. 557, figs. 110, 111, 114, 115 ; Veitch, 167 ; Beissner, 261, figs. ; Macoun, 466 ; Murray in *Gard. Chron.* 1866, p. 586.

SYNONYMS:—To this species are referred:—*P. Benthamiana*,

Hartweg, *Journ. Hort. Soc.* ii. 189, and iv. 212, with fig. *P. brachyptera*, Engelmann. *P. Beardsleyi*, Murray. *P. Craigiana*, Murray, and *P. Parryana*, Gordon, not Engelmann.

VARIETY:—SCOPULORUM, Engelmann ; Beissner, 263 ; var. PENDULA, see *Gard. Chron.* Aug. 24, 1878, 237, fig.

British Columbia, south and east, to Texas.

P. pontica, Koch. See *P. silvestris*.

P. Popocatepetlii, Roezl. See *P. Montezumæ*.

P. porphyrocarpa, Murray = *P. MONTICOLA* var.

P. prasina, Roezl. See *P. pseudostrobus*.

P. protuberans, Roezl ; Gordon = *P. pseudostrobus*.

57. *P. pseudostrobus*, Lindley ; Parlature, 401 ; Loudon, *Encycl.* f. 1887.

SYNONYM:—*P. Orizabæ*, Gordon in *Journ. Hort. Soc.* i. 238, figure.

Parlature refers seven of Roezl's so-called species to *P. pseudostrobus*.

Mountains of Mexico, 8,000–10,000 feet.

58. *P. pseudo-Tæda*, Tenore ; Parlature, l. c. 398.

Only known as a garden plant.

P. pumila. See *P. Cembra*.

P. Pumilio. See *P. montana*.

P. pyramidalis. See *P. montana*.

59. *P. pungens*, Michaux ; Parlature, l. c. p. 379 ; Lambert, *Pinus*, ed. 1, t. 17 ; Loudon, *Arboretum*, iv. figs. 2077 et seq. ; *Encycl.* f. 1804 ; Forbes, *Pinet. Woburn.* t. 5 ; Beissner, 214, fig. ; Veitch, 158.

Introduced in 1804 from the mountains of Virginia, Carolina, and Pennsylvania. Height 40–50 feet.

60. *P. pyrenaica*, Lapeyrouse ; Parlature, l. c. 385 ; *Gard. Chron.* Sept. 8, 1888, p. 268 (not to be confounded with *P. Laricio* var. PYRENAICA). The Calabrian Pine.

SYNONYMS:—*P. Brutia*, Tenore (1831), *Flor. Nap.* v. 266, t. 200 ; Lambert, *Pinus*, tom. 3, p. 125, t. 82 ; Loudon, *Encycl.* f. 1796 ; Beissner, 224 ; Boissier, *Flor. Orient.* v. 695. *P. carica*, Don ex Boissier, l. c. *P. Loiseleuriana*, Carrière, excl. syn. *P. Paroliniana*, Webb ; Visiani.

Mountains of Southern Europe, the Levant, etc.

P. radiata. See *P. insignis*.

61. *P. reflexa*, Engelmann ; *Gard. Chron.* 1875, p. 296 ; Sargent, *Census Report*, 189.

SYNONYM:—*P. flexilis* var. *reflexa*, Engelmann.

P. Regeliana, Roezl ; Gordon, ed. 2, 321 = *P. pseudostrobus*.

62. *P. resinosa*, Solander ; Parlature, p. 388 ; Loudon, *Arboretum*, iv. f. 2094–2097 ; *Encycl.* f. 1807 ; *Pinetum Woburn.* t. 6 ; Veitch, 159 ;

Beissner, 246; Macoun, 465; Lambert, *Pinus*, ed. 2, vol. i. p. 20, t. 14.

SYNONYM:—*P. rubra*, Michaux.

Newfoundland, Canada to Pennsylvania.

P. retracta, Roezl. See *P. Montezumæ*.

63. *P. rigida*, Miller; Parlature, 394; Lambert, ed. 1, t. 18; Loudon, *Arboretum*, f. 2123; *Encycl.* f. 1820; *Pinetum Woburn.* t. 13; Veitch, 169; Beissner, 267, fig.; *Garden*, Feb. 5, 1887, ex Loudon; Macoun, 467.

SYNONYMS:—*P. Loddigesii*, Loudon, *Arboret.* iv. 2269. *P. Tæda* var. *rigida*, Solander in *Hortus Kewensis*.

P. Richardiana, Roezl. See *P. Montezumæ*.

P. rigensis. See *P. silvestris*.

P. Rinzi, Roezl. See *P. Montezumæ*.

P. Rohanii, Roezl. See *P. Montezumæ*.

P. romana. See *P. Laricio*.

P. Royleana, Jameson in *Journ. Hort. Soc.* ii. 52, with figure, is probably *P. inops*, introduced into the garden of the Resident in Nepal.

P. rubescens, Roezl. See *P. Montezumæ*.

P. rubra, Michaux. See *P. resinosa*.

P. rubriflora, Loudon. See *P. montana*.

P. rudis. See *P. Hartwegi* and *protuberans*.

P. Rumelianæ. See *P. Montezumæ*.

P. rupestris. See *P. Banksiana*.

P. Russelliana, Roezl; Gordon, ed. 2, 321. See *P. Montezumæ*.

P. ruthenica, hort. See *P. inops*.

64. *P. Sabiniana*, Douglas; Parlature, l.c. 391; Loudon, *Encycl.* f. 1836, etc.; *Arboretum*, fig. 2138, etc.; Forbes in *Pinetum Woburn.* t. 23; *Pinet. Britan.* i. 85, t. 11; Veitch, 169; Beissner, 256; Masters in *Gard. Chron.* July 14, 1888, p. 43, with figure; and Jan. 12, 1889, p. 45, fig. 6, tree at Kew; Lemmon, *Second Report*, No. 14.

P. Salzmannii. See *P. Laricio*.

P. Sanctæ Helenæ. See *P. Pinaster*.

P. sanguinea. See *P. montana (uncinata)*.

P. San Rafaeliana. See *P. Montezumæ*.

P. sativa, Lam. See *Picea excelsa*.

P. scariosa. See *P. silvestris*.

P. scoparia, Roezl. See *P. Hartwegii*.

P. scotica. See *P. silvestris*.

65. *P. serotina*, Michaux; Parlature, l. c. 394; Lambert, *Pinus*, ed. i. t. 18; Loudon, *Encycl.* f. 1827; *Arboretum*, iv. fig. 2127, etc.; Forbes, *Pinet. Woburn.* t. 16.

SYNONYMS:—*P. Tæda* var. *alopeuroidea*, Loudon, *Arboretum*, iv.

2237. *P. rigida* var. *serotina*, Loudon, *Encycl. f.* 1824; Beissner, 268.

North Carolina.

66. *P. silvestris*, Linnæus; Parlature, l. c. 385; Lambert, *Pinus*, ed. 2, p. 1, t. 1; *Gard. Chron.* 1857, 758; *Gard. Chron.* July 26, 1884, fig. 26; Veitch, 156; Beissner, 225, figs.; Loudon, *Encycl.* fig. 1760, p. 769; *Gard. Chron.* June 13, 1885. Bud between the needles, fig. 171. The Scotch Fir.

VARIETIES:—Beissner cites vars. REFLEXA, FASTIGIATA, ERYTHRANTHERA, HAMATA, NEVADENSIS, ENGADINENSIS, RHETICA × (a cross between *P. montana* and *P. silvestris*); HEERI × (a cross between *P. uncinata* and *P. engadinensis*); PYRAMIDALIS × (a cross between *P. humilis* and *P. silvestris*); CHRISTI × (a cross between *P. humilis* and *P. silvestris*); VIRGATA, COMPRESSA, COMPACTA, PUMILA, PYGMÆA, PENDULA, PYRAMIDALIS, MONOPHYLLA, MICROPHYLLA, UMBRACULIFERA, VARIEGATA, AUREA. See also HAYNENSIS, *Gard. Chron.* 1869, p. 473.

SYNONYMS:—*P. rubra*, Miller. *P. Mughus*, Jacquin, *Icon. Rar.* t. 193; *rigensis*, Desfontaines, *genevensis*, *haguenoviensis*, *tortuosa*, *monophylla* (not of Torrey and Fremont), *scariosa*, *squamosa*, *argentea*, *Kochiana*, *armena*, *pontica*, are all mentioned as synonyms or as varieties by Parlature.

Northern Europe and Asia. Indigenous to the Highlands of Scotland. Very variable in habit, cone, etc.

P. Sinclairiana. See *P. ponderosa*.

P. Skinnerii, Roehl. See *P. filifolia* or *P. oocarpa*.

P. Smithiana. See *Picea Morinda*.

P. Soulangeana, Roehl. See *P. Montezumæ*.

P. spinosa, Roehl. See *P. Montezumæ*.

P. squamosa. See *P. montana* (*uncinata*).

P. spectabilis. See *Abies Webbiana*.

P. Standishii, Roehl. See *P. Hartwegii*.

P. St. Helenica. See *P. Pinaster*.

P. striata. See *Abies Webbiana*.

P. strobiformis. See *P. Ayacahuite*.

67. *P. Strobis*, Linnæus; Parlature, 405; Lambert, ed. 2, t. 35; Loudon, *Encycl. Trees*, fig. 1903; Veitch, 183; Beissner, 289, fig.; Macoun, 464. The Weymouth Pine.

VARIETIES:—NIVEA, NANA. For other varieties see Beissner l. c. Canada to the Alleghanies.

P. subpatula, Roehl. See *P. patula*.

P. suffruticosa. See *P. Hartwegii*.

P. tabuliformis. See *P. densiflora*.

P. Tamrac, A. Murray in *Gard. Chron.* 1869, p. 191, fig. See *P. contorta*.

P. tatarica, hort. See *P. Laricio*.

P. taurica. See *P. Laricio*.

P. taxifolia, Lambert. See *Pseudotsuga Douglasii*.

68. *P. Tæda*, Linnæus ; Parlature, l. c. 393 ; Lambert, *Pinus*, ed. 2, p. 20, t. 17, 18 ; *Pinet. Brit.* i. 89, t. 12 ; Loudon, *Arboret.* figs. 2118, etc. ; *Encycl.* f. 1817 ; *Pinetum Woburnense*, t. 14 ; Bentley and Trimen, *Med. Plants*, iv. 259 ; Veitch, 172 ; Beissner, 265.

VARIETY :—*TENUIFOLIA*.

South-Eastern States of North America to Texas and Arkansas (Sargent).

69. *P. tenuifolia*, Benthams ; Parlature, 400.

Not in cultivation. Guatemala.

70. *P. Teocote*, Chamisso and Schlechtendal ; Parlature, l. c. 396 ; Lambert, *Pinus*, ed. 2, t. 62 ; Loudon, *Encycl.* f. 1854, etc.

According to Parlature the following names bestowed by Roezl belong here : *Vilmoriniana*, *Besseriana*, *Mulleriana*, *microcarpa*, *Huegelii*, *interposita*, *Galocote*.

Mexico.

P. Thelemannii, Roezl. See *P. Montezumæ*.

P. Thibaudiana. See *P. Montezumæ*.

71. *P. Thunbergii*, Parlature in *DC. Prod.* xvi. 2, 389 ; Mayr, *Mon. Abiet. Japan.* 69, t. v. f. 16 ; Beissner, 248 ; Masters, *Journ. Linn. Soc.* xviii. 504 (1880) ; *Gard. Chron.* March 14, 1885, p. 345 (aggregate cones) ; bisexual cones of, June 30, 1883, p. 825.

SYNONYMS :—*P. silvestris*, Thunberg, not Linn. *P. pinaster*, Loudon, partly. *P. rubra*, Siebold. *P. Massoniana*, Siebold and Zuccarini, *Fl. Japan*, ii. p. 24, t. 113, 114 (not of Lambert) ; Murray, *Pines and Firs of Japan* ; Koch, *Dendrol.* ii. 282, p. 89.

VARIETY :—*P. TABULIFORMIS*, Carrière.

Mayr, l. c., describes a large number of varieties not as yet introduced, though doubtless they soon will be.

? *P. timorensis*, Loudon, *Encycl.* p. 1000.

P. tlamacaensis, Roezl. See *P. Hartwegii*.

P. tomacoensis, Roezl. See *P. Montezumæ*.

P. Troubetzkoyana, Roezl. See *P. Montezumæ*.

P. Tschugatskoi, Koch. See *Abies cilicica*.

72. *P. Torreyana*, Parry ; Carrière ; Gordon ; Veitch, 173 ; Beissner, 256 ; Lemmon, *Second Report*, tab. 15.

SYNONYM :—*P. lophosperma*, Lindley in *Gard. Chron.* 1860, 46 ; Parlature, 391.

California.

73. *P. tuberculata*, Gordon, not of Don, *Journ. Hort. Soc.* iv. 218, fig. ; Parlature, l. c. 394, partly and excl. references ; Loudon, *Encycl. Trees*, f. 1850 ; *Pinet. Brit.* i. 93, t. 13 ; Masters in *Gard. Chron.* Dec. 19, 1885, p. 784 ; Veitch, 170 ; Beissner, 270 ; Lemmon, *Second Report*, tab. 1, 17.

SYNONYMS :—*P. californica*, Hartweg, not Loiseleur. *P. attenuata*,

Lemmon in *Garden and Forest*, Feb. 10, 1892. (See under *P. insignis*.)

Oregon and west side of Californian coast ranges.

P. tumida, Roezl. See *P. Teocote*.

? *P. turbinata*, Bosc ex Loudon, *Encycl. Trees*, p. 975. See *P. inops*.

P. umbraculifera. See *P. Strobilus*.

P. uncinata. See *P. montana*.

P. valida, Roezl. See *P. Montezumæ*.

P. Van Houtteii, Roezl. See *P. Montezumæ*.

P. Van Geertii, Roezl. See *P. Montezumæ*.

P. variabilis. See *P. mitis* (echinata) and *P. inops*.

P. Veitchii, Roezl. See *P. Ayacahuite*.

P. variegata?

P. Verschaffeltii. See *P. Montezumæ*.

P. Vilmoriniana. See *P. Teocote*.

P. virginiana. See *P. inops*.

P. Wilsonii, Roezl. See *P. Montezumæ*.

P. Winchesteriana, Journ. Hort. Soc. ii. (1847) 158 = *P. Montezumæ*.

P. Zacatlana. See *P. Montezumæ*.

P. Zamaroensis, Roezl. See *P. filifolia*.

P. Zilacuarii, Roezl. See *P. Montezumæ*.

PODOCARPUS, L'Heritier ; Bentham and Hooker, *Genera Plantarum*, iii. 434 ; Parlatores in *DC. Prod.* xvi. 2, 507 ; Eichler, 103, fig. ; Kirk, *Forest Flora of New Zealand*. (TAXACEÆ, tribe *PODOCARPEÆ*.)

The species are very imperfectly known. They are trees with great diversity of foliage sometimes on individual trees. Stamens in tufted spikes. Pollen winged or globose ; stalk bearing the arillate seeds, swelling when ripe into a succulent mass around the inverted seed. Cotyledons 2, leafy.

1. *P. alpina*, Brown ; Parlatores, 520 ; Veitch, 318 ; Beissner, 194. Tasmania.

P. andina. See *Prumnopitys*.

P. antarctica, hort. See *P. curvifolia*, *vide* Carrière.

P. canaliculatus, hort. See *P. chinensis*, Wall. *vide* Carrière.

2. *P. chilina*, Richard ; Parlatores, 511 ; Veitch, 319. Andes of Chile. Introduced 1853 (Veitch).

3. *P. chinensis*, Wallich ; Parlatores, 516 ; Veitch, 317 ; Beissner, 193.

China and Japan.

4. *P. curvifolia*, Carrière, *Conif.* ed. 2, p. 651 ; Parlatores, 517. A doubtful plant of unknown origin.

P. coreana and *P. coriacea*, hort. = *Torreya nucifera*, *fide* Carrière.

5. *P. ferruginea*, Don ; Parlature, 519 ; Kirk, *Forest Flora of New Zealand*, t. 84.

New Zealand. Cultivated in Edinburgh Botanic Garden.

P. flabelliformis, *flagelliformis*, *Fortunei*, *japonica* are garden names, but to what they refer I do not know.

P. latifolia, hort. See *P. cuspidata*.

P. linearis, hort. See *P. elongata*.

P. longifolia. See *P. macrophylla*.

6. *P. macrophylla*, Don ; Parlature, 517 ; Veitch, 317 ; Beissner, 194.

Japan. Cultivated in Edinburgh Botanic Garden.

7. *P. Mannii*, Hook. f. ; Parlature, 511.

West Africa. Cultivated in the Botanic Garden of Coimbra.

8. *P. Nagæia*, Brown ; Parlature, 508 ; Veitch, 317.

VARIETIES :—*VARIEGATA*, *ROTUNDIFOLIA*.

Japan.

9. *P. neriifolia*, Don ; Parlature, 514 ; Hook. *Flor. Brit. India*, v. 649 ; *Flore des Serres*, viii. 49, t. 768 ; *Bot. Mag.* 4645.

Eastern Himalaya. Cultivated in Hort. Antibes, whence I received specimens from M. Naudin.

P. nobilis, hort. = *P. Endlicherianum*, *fide* Carrière.

10. *P. nubigena*, Lindley in *Paxton Flower Garden*, 1851, p. 162, f. 218 ; Parlature, l.c. 513 ; Veitch, 318 ; Masters in *Gard. Chron.* Aug. 8, 1891, p. 171, fig. 23.

Introduced from Chile in 1849 by W. Lobb, through Messrs. Veitch.

P. pinnata, hort. See *P. latifolia*, Gordon.

P. pingens, hort. See *P. Totara*.

P. Purdieana, hort. See *P. curvifolia*.

P. spinulosa, hort. See *P. macrophylla* and *P. Totara*.

11. *P. Totara*, Don ; Parlature, 514 ; Veitch, 319 ; Kirk, *Forest Flora of New Zealand*, tab. cxv.

SYNONYM :—*P. variegatus*, *Gard. Chron.* 1861, 735.

New Zealand.

12. *P. vitiensis*, Seemann ; Nicholson in *Gard. Chron.* April 10, 1886, p. 464, fig.

P. Vriesiana. See *P. chinensis*.

P. Yacca. See *P. coriacea* or *latifolia* (*Kew Index*).

In addition to the above more or less doubtfully hardy species, the following are mentioned in the *Kew Bulletin* for April 1892 as in cul-

tivation under glass in that establishment. *P. bracteata*, Blume, Java; *P. dacrydioides*, A. Rich. New Zealand; *P. elongata*, L'Heritier, South Africa; *P. elata*, R. Br. Australia; *P. japonica* and var. *VARIEGATA*, Siebold, Japan; *P. neriifolia*, Don, Nepal; *P. spicata*, R. Br. New Zealand; *P. taxifolia*, Kunth in Humb. et Bonpl. *Nov. Gen.*, New Granada; *P. coriacea*, Richard, Jamaica; *P. pectinata*, Pancher MSS., New Caledonia; *P. Purdieana*, Hook., West Indies; *P. salicifolia*, Klotzsch, West Indies. Descriptions of most of these will be found in Parlature, l. c. 507, et seq. Figures of the New Zealand species will be found in Kirk's *Forest Flora of New Zealand*.

PRUMNOPITYS (= *Podocarpus*, § *Stachycarpus*, Endlicher; Benth. et Hook. iii. 435.) *STACHYCARPUS* (gen.), Van Tieghem, *Bull. Soc. Bot. France*, 1891. (TAXACEÆ, Tribe *PODOCARPEÆ*.)

Evergreen tree or shrub, like *Podocarpus*, but with the fruits on a loose spike instead of solitary on a fleshy stalk. According to Van Tieghem, the root structure is also peculiar in having resin canals within the pericycle, such as exist in the root of *Araucaria* and *Dammara*, but not in the *Cupressineæ* nor in the *Taxaceæ*.

1. *P. elegans*, Philippi; Lindley in *Gard. Chron.* Jan. 3, 1863, p. 6; Carrière, ed. 2, p. 682; Veitch, 316.

SYNONYMS.—*Podocarpus andina*, Poeppig; Parlature, 520; Beissner. *Stachycarpus andina*, Van Tieghem, l. c.

Introduced from Chile by Pearce in 1860.

PSEUDOLARIX, Gordon, *Pinetum*, 292 (1858); Eichler, *Pflanzen-famil.* ii. 69, fig. (Tribe *ABETINEÆ*.)

This genus, established by Gordon, was not taken up by Bentham and Hooker, who considered it allied to *Cedrus*, or as likely to form a new genus when further information came to hand. This is now forthcoming, and Gordon's genus may be considered as confirmed. It is like the Larch in habit, but the spike-like male flowers are in umbellate tufts as in Ginkgo.

1. *P. Kämpferi*, Gordon, *Pinetum*; Beissner, 310, fig. from *Gard. Chron.*; Masters, *Gard. Chron.* May 3, 1884, p. 584, fig. 112, male flowers; August 23, 1884, p. 241, fig. 48, cones; *Journ. Linn. Soc.* xxii. 209. The Golden Larch.

SYNONYMS.—*Larix Kämpferi*, Carrière; Veitch, 129; *Garden*, Oct. 1875, fig. *Pinus Kämpferii*, Lambert; Parlature, 413. *Abies Kämpferii*, Lindley in *Gard. Chron.* July 15, 1854, p. 455, and 1855, p. 644, cut. *P. Fortunei*, Mayr, *Mon. Abiet. Japan.* 99 (1890).

Northern China.

Fruited at Lucombe & Pince's Nursery, Exeter, in 1887. For cones and male flowers, I am indebted to Messrs. Rovelli of Pallanza. Mayr says that the true Kämpfer's Larch is the species known as *Larix laricina* and proposes to shift the name accordingly.

PSEUDOTSUGA, Carrière, ed. 2, p. 256 (1867); Bentham and Hooker, *Gen. Plant.* iii. 441; Eichler, 81. (Tribe ABIETINEÆ.)

A genus constructed for the reception of the Douglas Fir. The habit and foliage are those of the Silver Firs, the male flowers like those of *Picea*; cones pendent, ripening in the first year; scales persistent; bracts markedly three-lobed; wing of seed narrow, pointed; cotyledons 5-7, 3-sided, entire as are the primary leaves. It differs from the Spruces in the foliage. The structure of the wood is quite distinct.

1. **P. Douglasii**, Carrière, *Traité des Conifères*, ed. 2, p. 256; Sargent, *Garden and Forest*, Oct. 16, 1889, and May 6, 1891; Macoun, 473; Beissner, 411, fig. 413. The tree at Dropmore, *Gard. Chron.* 1874, p. 325. The Douglas Fir.

SYNONYMS:—*Abies taxifolia*, Poirét (1804). *Pinus taxifolia*, Lambert, ed. 1, t. 33 (1803). *Pinus Douglasii*, Lambert, ed. 2 (1828), vol. iii. t. 90; Parlatores, 430. *Pseudotsuga taxifolia*, Britton; Lemmon, *Third Report*, tab. 10, 11. *Abies Douglasii*, Lindley; Veitch, 119, f. 35; Loudon, *Encycl.* 1031, f. 1932; *Pinet. Brit.* ii. 115, t. 17, 18. *Picea Douglasii*, Link. *Tsuga Douglasii*, Carrière.

VARIETIES:—Veitch admits the following:—**PENDULA**, **STANDISHII**, **TAXIFOLIA** (Loudon, *Encycl.* 1033, f. 1932). In addition there are mentioned: **ELEGANS**, **STAIRII** (variegated), **COMPACTA**, **MACROCARPA** (Torrey; Lemmon, *Third Report*, n. 12), **MONSTROSA**, **GLAUCA**, and **REVOLUTA**.

British Columbia to Colorado, Texas, and Mexico. It varies greatly from seed, and according to locality.

Retinospora, Siebold and Zuccarini (see **CUPRESSUS**, section **CHAMÆCYPARIS**, **JUNIPERUS**, **BIOTA**, and **THUYA**). Sometimes written *Retinispora*. The so-called species are really forms or stages of growth of a few species of one or other of the above-named genera, so that two or three forms may sometimes be seen on one bush. These forms may be perpetuated by cuttings or grafts, which retain their characteristics for an uncertain period. The principal forms are the following:—

R. andelyensis syn. *R. leptoclada*, a form of **Cupressus Thyoides**.
? *R. decurvata*, Carrière.

R. decussata = a state of **Thuia orientalis**, *vide* Beissner.

? *R. Devriesiana*, hort.

R. dubia = a state of **Thuja occidentalis**.

R. Elwangeri = a state of **Thuja occidentalis**.

R. ericoides = a state of **Thuja orientalis** and sometimes also of **Cupressus Thyoides**.

R. filicoides = a state of **Cupressus obtusa**.

R. filifera = a state of **Cupressus obtusa**.

R. juniperoides = a form of **Thuja orientalis**, *vide* Beissner.

- R. leptoclada* = a state of *Cupressus thyoides*.
R. lycopodioides = a state of *Cupressus pisifera*.
R. meldensis = a state of *Thuya orientalis*.
R. obtusa = *Cupressus obtusa*.
R. pisifera = *Cupressus pisifera*.
R. plumosa = a state of *Cupressus pisifera*.
 ? *R. pseudo-squarrosa* = a form of *Cupressus Thyoides*.
R. squarrosa = a state of *Cupressus pisifera*.
R. tetragona = a state of *Cupressus obtusa*.
R. Troubetzkoyana = *Cupressus obtusa*.

Red Wood. See *Sequoia sempervirens*.

Savin. See *Juniperus Sabina*.

SAXEGOTHEA, Lindley in *Journ. Hort. Soc.* vi. 258 (1851), with fig.; Bentham and Hooker, iii. 434; Parlature in *DC. Prod.* xvi. 2, 497; Eichler, 103. (TAXACEÆ. Tribe *PODOCARPEÆ*.)

An evergreen shrub or tree, with foliage resembling that of the Yew. Male flowers in stalked cylindrical spikes. Anthers 2-lobed, pollen grains globose, not winged. The scales bearing the seed are much thickened, and the inverted seed springs from a cavity towards the middle.

1. *S. conspicua*, Lindley, l. c.; and in Paxton, *Flower Garden*, 1851; Parlature, l. c.; Veitch, 315; Beissner, 195; Masters in *Gard. Chron.* Dec. 3, 1887, p. 684, figs. 130, 131, and June 22, 1889, p. 782, with fig. of small flowers. Prince Albert's Yew.

Introduced by W. Lobb from Southern Chile, through Messrs. Veitch, in 1849.

S. gracilis, hort. See *Podocarpus nubigena* (*Kew Index*).

SCIADOPITYS, Siebold and Zuccarini, *Flor. Japan*, ii. t. 101; Bentham and Hooker, *Genera Plantarum*, iii. 437; Parlature in *DC. Prod.* xvi. 2, 435; *Gard. Chron.* 1862, p. 23, and 1861, p. 360; Masters in *Journ. of Botany*, April, 1884; and in *Journ. Linn. Soc.* xviii. 502; for details of structure, Eichler, 85, fig. (Tribe *TAXODIÆÆ*.)

Remarkable in the verticillate rays of "cladodes" or foliage of peculiar structure. Male spikes terminal, anther-lobes 2. Bracts and scales united into a thick lobulated mass, with 7-9 2-winged seeds to each. Cotyledons 2, leafy. Primary leaves oblong, linear.

1. *S. verticillata*, Siebold and Zuccarini, l. c.; Murray, *Pines and Firs of Japan*, p. 109, fig.; Parlature, l. c.; Lindley in *Gard. Chron.* 1861, pp. 22, 360, fig.; Masters in *Journ. Linn. Soc.* l. c.; Veitch, 201, fig.; Beissner, 203, with fig.; *Garden*, Nov. 29, 1890, fig. The Umbrella Pine of Japan.

Introduced in 1861 by J. G. Veitch, and also by Fortune. Nineteen feet in height in 1889, at Bagshot Park.

SEQUOIA, Endlicher ; Benth. and Hook. iii. 429 ; Parlature in *DC. Prod.* xvi. 2, p. 435 ; Eichler, 85, fig. ; Asa Gray, "Sequoia and its History," *Scientific Papers*, vol. ii. p. 142. **WELLINGTONIA**, WASHINGTONIA. (Tribe TAXODIÆ.)

Evergreen trees with small leaves scattered, or apparently in two ranks. Flowers monœcious ; male flowers in terminal stalked oblong or globose heads ; anther-lobes 2-5 ; pollen globose. Cone scales and bracts united into a woody wedge-shaped or peltate mass. Seeds 4-9, winged, without resin canals.

1. **S. gigantea**, Torrey ; Parlature, 437 ; Beissner, l. c., 160 ; Decaisne, *Bull. Bot. Soc. France*, i. 70 ; *Revue Hortic.* 1855, p. 9, t. 10 ; Hoopes, *Evergreens*, 239, f. 29 ; *Garden*, Dec. 9 and Dec. 16, 1871 ; *Garden and Forest*, Dec. 25, 1889, Nov. 26, 1890, p. 570 ; Lemmon, *Third Report*, 1890, t. 19.

SYNONYMS:—*Wellingtonia gigantea*, Lindley in *Gard. Chron.* 1853, p. 823 ; W. Hook. *Bot. Mag.* t. 4777, 4778 ; Veitch, 204 ; Lemmon, *Third Report*, No. 19. *Sequoia Wellingtonia*, Seemann, *Pinetum Britannicum*, iii. 299, t. 37, and t. 51-53, f. 1-37. The *Wellingtonia*, or Mammoth Tree, "arbor vegetabilium omnium gigas et Floræ decus."

Tree 250-400 feet in height. Introduced in 1853 by William Lobb from the western side of the Sierra Nevada.

Eight varieties are cited by Beissner, the pendulous form being the most remarkable.

2. **S. sempervirens**, Endlicher ; Parlature, 436 ; Veitch, 212 ; Decaisne in *Revue Horticole* (1855), with figs. ; Hoopes, *Evergreens*, 244 ; Beissner, 157, fig. ; *Pinet. Britannicum*, iii. with fig. ; Murray in *Gard. Chron.* 1866, p. 971, l. c. ; Lemmon, *Third Report*, 1890, t. 18 ; *Gard. Chron.* Sept. 13, 1890, p. 307, figs. 60-63. The Red Wood of California.

SYNONYM:—*Taxodium sempervirens*, Lambert, ed. 2, t. 52 ; Loudon *Arboretum*, f. 2340.

VARIETIES:—*APPRESSA*. *ALBO-SPICA*.

Introduced by Hartweg in 1846 ; but known many years before.

S. taxifolia, Koch = *S. sempervirens*.

Spruce. See *Picea*.

Spruce, Douglas. See *Pseudotsuga*.

Spruce, Hemlock. See *Tsuga*.

TAXODIUM, L. C. Richard ; Benth. et Hook. iii. 429 ; Parlature, p. 439 ; Eichler, 90. (Tribe TAXODIÆ.)

Trees with deciduous foliage. Male flowers in branched catkins. Anther lobes 5-8. Cone scales thick, peltate ; seeds erect, angular, with projecting points, but without wings. Cotyledons 6-9, 3-angular. See *Glyptostrobus* and *Sequoia*,

1. *T. distichum*, Richard ; Parlatore, 440 ; Veitch, 214 ; Loudon, *Arboretum*, f. 2335 ; *Encycl. Trees*, 1079, f. 2006 ; *Pinet. Woburn*. t. 60 ; *Pinet. Britan.* ii. 205 ; Beissner, 148, fig. ; *Garden*, Nov. 30, 1872, and May 3, 1873 ; *Garden and Forest*, Jan. 1 and 8, 1890 ; Tree at Sion, *Gard. Chron.* Sept. 16, 1882, p. 361 ; and *Gard. Chron.* March 15, 1890, p. 324, figs. 49-50, and supplementary plate ; Gnaur on root, *Gard. Chron.* March 22, 1879, p. 372 ; proliferous cone of, *Gard. Chron.* July 31, 1886, p. 148 ; A. Gray, *Scientific Papers*, ii. 112. The deciduous Cypress.

SYNONYMS :—*Cupressus disticha*, Linnæus. *T. microphyllum*, Brongniart. *T. adscendens*, Brongniart.

VARIETIES :—PENDULA, Veitch, 215 ; *Pinetum Woburnense* = *Glyptostrobus pendulus*, Endlicher ; and *Bot. Mag.* 5603 = *Taxodium sinense*, Gordon. MICROPHYLLA, Parlatore, 441 = *T. sinense pendulum*, Pinet. Woburn. 108. ADSCENDENS, Carrière. FASTIGIATUM, Carrière.

Carrière describes fifteen varieties !

Introduced by Tradescant in or about 1640. Southern States of America, in wet places.

T. fastigiatum. See *T. mucronatum*.

T. giganteum. See *Sequoia sempervirens*.

T. heterophyllum. See *Glyptostrobus*.

T. Horsfieldii, Knight. See *Podocarpus cupressina*.

T. imbricatum, hort. See *T. distichum*.

2. *T. mucronatum*, Tenore ; Parlatore, p. 441.

SYNONYMS :—*T. Montezumæ*, Decaisne ; *Pinet. Britan.* ii. 215, t. 36. *T. mexicanum*, Carrière ; Beissner, 155. *T. distichum mexicanum*, Gordon. *T. distichum*, Cypress of Montezuma, *Garden and Forest*, March 26, 1890, fig. 28.

Mexico ; at alt. 5,000-7,000 feet. Hardly distinct from *T. distichum*.

T. japonicum, Dehn, ex Gordon = *Glyptostrobus heterophyllus*.

T. juniperoides. See *Widdringtonia* ?

T. Knightii, hort. ex Koch = *T. distichum*.

T. mexicanum, Carr. See *T. mucronatum*.

T. microphyllum, Brongn. See *T. distichum*.

T. Montezumæ. See *T. mucronatum*.

T. muciferum, Brongn. See *Glyptostrobus heterophyllus*.

T. nutkaense, Lamb. = ? *Sequoia sempervirens*.

T. pinnatum, hort. ex Carr. = *T. mucronatum*.

T. sempervirens. See *Sequoia*.

T. sinense. See *Glyptostrobus*.

T. sinense, Noisette. See *T. distichum*.

T. Washingtonianum. See *Sequoia gigantea*.

TAXUS, Linnæus ; Benth. and Hook. t. iii. 431 ; Eichler, 108, fig. (TAXACEÆ, Tribe TAXEÆ.)

Evergreen trees, with 2-ranked leaves, flowers dicecious ; stamens in stalked heads ; anther-scales peltate ; pollen globose ; seed solitary, erect, and borne in a scarlet, fleshy cup or aril. Cotyledons 2, leafy, flat, green on both sides, without resin-canals. Primary leaves similar in form, but smaller.

T. adpressa, Revue Horticole, 1855, p. 93, f. 8. Referred by Parlature to *T. tardiva* ; by others to *T. baccata*, or to *T. cuspidata*.

1. **T. baccata**, Linnæus ; Parlature, xvi. 2, 500 ; Loudon, *Encycl. Trees*, fig. 1752 ; Veitch, 296 ; Beissner, 167, fig. ; Boissier, *Flor. Orient.* v. 711. The Yew.

Europe and Northern Asia.

Of this there are very numerous varieties, for an account of which see Veitch, l. c., and Beissner. They include the forms known as *APPRESSA*, *AUREA*, *DOVASTONI*, *ELEGANTISSIMA*, *ERECTA*, *ERICOIDES*, *FASTIGIATA* (the Irish Yew), the *T. HIBERNICA* of Mackay (*Flor. Hibern.* p. 260), *NANA*, *NIGRA*, and various forms with variegated or coloured foliage, or yellow fruit.

The following names applied to forms or varieties also belong, or are supposed to belong, to this species : *COLUMNARIS*, *DISTICHA*, *EMPETRIFOLIA*, *EXPANSA*, *FOXII*, *HORIZONTALIS*, *IMPERIALIS*, *JACKSONII*, *LUGUBRIS*, *MARGINATA*, *MICHELII*, *MICROPHYLLA*, *MITCHELLII*, *MONSTROSA*, *NANA*, *NEPALENSIS*, *ORIENTALIS*, *PECTINATA*, *PENDULA*, *PYRAMIDALIS*, *RECURVATA*, *SPARSIFOLIA*, *STRICTA*, *UMBRACULIFERA*, *VARIEGATA*, *VIRGATA*.

2. **T. brevifolia**, Nuttall, *Silva*, iii. tab. 208 ; Parlature, 501 ; Veitch, 305 ; Lemmon, *Third Report*, No. 30 ; Macoun, 463.

SYNONYMS.—*T. Boursierii*, Carrière in *Rev. Hort.* 1854, 228, figure.
T. Lindleyana, Murray. *T. baccata* var. *canadensis*, Bentham.
North-west America, British Columbia to California.

3. **T. canadensis**, Willdenow ; Parlature, 501 ; Loudon, *Encycl.* fig. 2105 ; Veitch, 305.

SYNONYM.—*T. baccata* var. *canadensis*, Gray ; Macoun, 463.
Canada and North-Eastern States of America.

T. columnaris. See **T. baccata**.

4. **T. cuspidata**, Siebold and Zuccarini ; Parlature, 502.

SYNONYMS.—*T. adpressa* of gardens is supposed to belong here, and to be the *T. tardiva* of Lawson.
Mountains of Japan.

T. floridana of Nuttall and Carrière is not in cultivation. (?)

T. Harringtonia, Knight ; Loudon, *Encycl.* 943, fig. = *Cephalotaxus pedunculata*,

- T. imukaja.* See *Cephalotaxus pedunculata*.
T. japonica. See *Cephalotaxus drupacea* or *C. pedunculata*.
T. Lindleyana. See *T. brevifolia*.
T. longifolia. See *Podocarpus macrophyllus*.
T. Makoya. See *Podocarpus macrophyllus*.
T. nana. See *T. baccata*.
T. nucifera. See *Torreya*.
T. patagonica. See *Saxegothea*.
T. sinensis. See *Cephalotaxus pedunculata*.
T. verticillata. See *Sciadopitys*.
T. Washingtonii. See *T. canadensis*.

TETRACLINIS. (*Callitris* and *Frenela* of authors variously.)

It differs from *Callitris*, all of which are exclusively Australian, in its flattened, not angular stem, solitary cone, &c. The pollen is globose and unwinged. (Tribe CUPRESSINÆ.)

1. *T. articulata*.

SYNONYMS.—*Callitris quadrivalvis*, Ventenat (1808); Parlatores, 452; Richard, *Conif.* 46, t. 8; Endlicher; Carrière; Gordon; Eichler, 95, fig; Loudon, *Encycl.* 1072, f. 1995. *Thuya articulata*, Vahl. (1791). *Frenela Fontanesii*, Mirbel.

Algiers, Morocco. Royal Gardens, Kew, cult.

THUYA, Linn. (with *THUYOPSIS*, *BIOTA*, *PLATYCLADUS*); Benth. et Hook. iii. 426, partly. (Tribe CUPRESSINÆ.) Parlatores, in *D. C. Prod.* xvi. ii.; Brown (Campster), *Monog. Thuya* and *Libocedrus*, *Trans. Bot. Soc. Edinburgh*, 18, 358; Eichler, *Pflanzenfamilien*, fig. (Tribe CUPRESSINÆ, Sub-tribe THUINÆ.)

Evergreen trees or shrubs with flattened branch-systems, minute appressed leaves, globular or oblong cones the scales of which are thickened upwards (not peltately expanded as in *Cupressus*). The two uppermost pairs of scales are fertile (not one only, as in *Libocedrus*). Seeds usually winged equally on both sides. § *Biota* has wingless seeds.

- T. acuta.* See *T. orientalis*.
T. andina = *Libocedrus chilensis*.
T. antarctica. See *T. orientalis*.
T. argentea = *T. orientalis*.
T. articulata = *Tetraclinis*.
T. asplenifolia. See *T. plicata* (*gigantea*).
T. aurea = *T. orientalis*.
T. australis = *T. orientalis*.
T. californica. See *T. plicata* and *T. gigantea*.
T. canadensis = *T. occidentalis*.

T. chilensis = **Libocedrus**.

T. chinensis = **T. orientalis**.

T. compacta = **T. occidentalis**.

T. Craigana, Murray = **Libocedrus decurrens**.

T. Craigana, Jeff. = **T. gigantea**.

T. cristata, Carr. = **T. orientalis**; applied also to a form of **T. occidentalis**.

T. cupressoides, hort. See **T. orientalis**.

T. curviramea, Miquel. See **Cupressus torulosa**.

T. decora. See **T. orientalis**.

T. Devriesiana, cfr. **Retinospora dubia**?

1. **T. dolabrata**, Linnæus, *Suppl. Pl. Syst.* ed. xiii. 420; Masters in *Journ. Linn. Soc.* xviii. p. 486; *Gard. Chron.* Oct. 28, 1882, p. 556.

SYNONYM:—*Thuyopsis dolabrata*, Siebold and Zuccarini, *Flor. Japan*, ii. p. 32, t. 119; Veitch, 265; Beissner, 51, with fig.; Eichler, 95.

VARIETIES:—**NANA**, **VARIEGATA**, **LETE-VIRENS**. See Veitch, p. 266; Beissner, l. c.

Mountains of Japan.

T. Doniana = ? **Libocedrus**.

T. Douglasii. ?

T. dumosa = **T. orientalis**, var.

T. elegantissima, hort. = **T. orientalis** forma.

T. Ellwangeriana, hort. = **T. occidentalis** forma.

T. ericoides, hort. = ? **T. orientalis** forma.

T. excelsa, Bongard = **Cupressus nootkatensis**.

T. excelsa, hort. = **T. orientalis** forma.

T. falcata, hort. = **T. orientalis**.

T. filiformis, Lodd. = **T. orientalis**.

T. flagelliformis = **T. plicata**?

T. Fortunei = **T. orientalis**.

T. freneloides, hort. = **T. orientalis**.

funiculata, Gordon = **T. orientalis**.

2. **T. gigantea**, Nuttall; Parlatore, 457; Brown, Campst. in *Trans. Bot. Soc. Edinb.* ix. 367; Hoopes, *Evergreens*, 315; Veitch, 256; Macoun, 460; Lemmon, *Third Report*, 20; Sargent in *Garden and Forest*, March 11, 1891, fig.

SYNONYMS:—*Thuya Lobbi* of gardens. *T. Menziesii*, Carrière. *T. Craigana* of gardens.

To this Brown and also Sargent refer *T. plicata*, Don. Alaska to California and western slopes of Montana.

T. glauca, hort. = **T. orientalis**.

T. gracilifolia, hort. = **T. orientalis**.

T. Hovei = **T. occidentalis**.

T. hybrida. See **T. orientalis**, forma **Meldensis**.

T. inæqualis?

T. intermedia = **T. orientalis**.

3. *T. japonica*, Maximowicz in *Bull. Acad. St. Petersb.* x. (1866) 490; Masters in *Journ. Linn. Soc.* vol. xviii. p. 486.

SYNONYMS.—*Thuya Standishii*, Carrière; Veitch; Beissner, 49; *Gard. Chron.* May 8, 1880, and of gardens. *Thuyopsis Standishii*, Gordon. *Thuya gigantea* var. *japonica*, Parlature, 457.

In gardens a form of *T. orientalis* is also known as *T. japonica*. Native of the mountains of Japan (Maries).

T. japonica, hort. See *Retinospora dubia* = *T. occidentalis* forma.

T. lætevirens. See *T. dolabrata*.

T. lineata. See *Taxodium heterophyllum*.

T. Lobbi = *T. gigantea*.

T. macrocarpa.

T. macrolepis.

T. Meldensis = *T. orientalis* forma.

T. Menziesii = *T. gigantea*.

T. minor = *T. occidentalis* var. See also var. *dumosa*.

T. monstrosa, hort. = *T. orientalis*.

T. nana. Var. of *T. orientalis*; also of *T. occidentalis* and *Cupressus obtusa*.

T. nepalensis = *T. orientalis*.

T. obtusa. See *Cupressus obtusa*.

4. *T. occidentalis*, Linnæus; Loudon, *Encycl.* 1069, f. 1991; *Arboretum*, f. 2312; Forbes, *Pinet. Woburn.* 193; R. Brown, Campster in *Trans. Soc. Bot. Edinb.* ix. 363; Parlature, 458; Veitch, 261; Beissner, 32, with figs.; Macoun, *Catalogue of Canadian Plants*, 459.

VARIETIES.—Brown, in his Monograph of *Thuya*, l. c., admits the following varieties: *VARIEGATA*, *ODORATA*, *ARGENTEA*, *COMPACTA*, *CAUCASICA*, *ROBUSTA* (including *WAREANA*, *ASPLENIFOLIA*, and *DUMOSA*), *PENDULA*, *VERVANEANA*, *ERICOIDES*, and ? *TATARICA*. In addition to these Beissner, l. c. 39, gives as varieties: *SPATHII* (= *OHLENDORFII* and *TETRAGONA*, hort.); *SIBIRICA* = *WAREANA*, hort., not Booth; *CAUCASICA* and *DENSA*), *LUTESCENS*, *GLOBOSA*, *FASTIGIATA* = *PYRAMIDALIS*, *STRICTA*, *COLUMNARIS*, *L'HAVEANA*, *ROSENTHALII*, *VIRIDIS*, *THEODONENSIS*, *MAGNIFICA*, *RIVERSII*, *LUTEA*, *LUTEA NANA*, *AUREA*, *REFLEXA*, *BODMERII*, *ATHROTAXOIDES*, *RECURVATA*, *DENUDATA*, *FILICOIDES*, *CRISTATA*, *BOOTHII*, *GLOBULARIS*, *HOVEI*, *SPIELMANNII*, *FRÉBELII*, *PUMILA*, *LITTLE GEM*, *ALBO-VARIEGATA*, *SILVER QUEEN*, *AUREO-VARIEGATA*, *ALBOSPICA*. Only a few of these, however, can be definitely identified.

5. *T. orientalis*, Linnæus; Parlature, 461; Loudon, *Encycl.* 1071, f. 1992. (§ *BIOTA*.) Chinese *Arbor Vitæ*.

SYNONYM.—*Biota orientalis*, Endlicher; Beissner, 55, with cuts; Veitch, 252; Boissier, *Flor. Orient.* v. 704; Loudon, *Encycl.* 1071, f. 1993.

VARIETIES.—*PENDULA* = *T. PENDULA* of gardens; *ERICOIDES* = *RETI-*

NOSPORA ERICOIDES of gardens. It is a stage of growth of the eastern Arbor Vitæ. MELDENIS, a juvenile form. Beissner also cites as varieties: PYRAMIDALIS, TATARICA (Lindley and Gordon; and *Pinetum Woburnense*), CUPRESSOIDES, STRICTA, AUSTRALIS, DECUSSATA (= *Ret. juniperoides*, SQUARROSA, hort., not of Zucc.; GLAUCA; FRENELA GLAUCA, hort.), GRACILIS, COMPACTA, NEPALENSIS, FRENELOIDES, JAPONICA (not of Siebold), ZUCCARINIANA, SIEBOLDII, NANA, AUREA, WEIMERII, ELEGANTISSIMA, SEMPERAURESCENS, LAXENBURGENSIS, AUREO-VARIEGATA, ARGENTEO-VARIEGATA, VERSCHAFFELTHII, FALCATA, MONSTROSA, CRISTATA GLAUCA, DUMOSA, ORIENTALIS, ANTARCTICA, PYGMEA, Densa GLAUCA, MINIMA GLAUCA, INTERMEDIA FILIFORMIS (including PENDULA, FLAGELLIFORMIS and FILIFORMIS STRICTA), TETRAGONA. Many of these are nursery names incapable of accurate determination.

China, Japan.

T. pendula = *T. orientalis*.

T. pisifera. See *Cupressus pisifera*.

6. *T. plicata*, Don; Lambert, i. 11; Loudon, *Arboretum*, iv. 2458; Parlatore, 457; Veitch, 263.

SYNONYMS:—*T. occidentalis plicata*, Loudon, *Encycl. Trees*, f. 2108; Hoopes, *Book of Evergreens*, 321. *T. Warreana*, Booth, *Cat.* (not of others). *T. gigantea* var. *plicata*, R. Brown, Campster; Sargent, *Census Report*, 177.

The original *T. plicata* was a North-west American form, whence Brown (of Campster), l. c., considers it to have been a variety of *T. gigantea*. Others put it under *T. occidentalis*. For garden purposes *T. plicata* is a distinct form.

T. pygmaea. See *Cupressus obtusa*, var. and *T. orientalis*.

T. pyramidalis. See *T. orientalis*.

T. recurva nana. See *T. orientalis*.

T. semperaurescens. See *T. orientalis*.

T. sibirica. See *T. occidentalis*.

T. sphæroidea, Sprengel; Macoun, 461 = *Cupressus thyoides*.

T. Standishii. See *T. japonica*, Max.

T. stricta. See *T. orientalis*.

T. tatarica. See *T. occidentalis*.

T. variegata. See *T. occidentalis*.

T. Vervaeana. See *T. occidentalis*.

T. Wareana. See *T. occidentalis*.

T. Zuccarinii. ?

THUYOPSIS.

borealis. See *Cupressus nootkatensis*.

cupressoides. ?

dolabrata. See *Thuya dolabrata*.

laetevirens. See *Thuya dolabrata*.

Standishii. See *Thuya japonica*.

Tschugatskoi. See *Cupressus nootkatensis*.

TORREYA, Arnott; Benth. and Hooker, *Genera Plantarum*, iii. 431; Parlatores in *DC. Prod.* xvi. 2, 504; Eichler, 108. (TAXACEÆ, Tribe SALISBURIEÆ.)

Evergreen trees, with linear leaves in two ranks. Seed erect, the size of a walnut, green and fleshy externally when ripe, with aril undeveloped. Albumen ruminant, like that of a nutmeg.

1. **T. californica**, Torrey in *New York Journ. Pharmacy*, iii. 49; Parlatores, 506; Beissner, 188; Lemmon, *Third Report*, n. 29; *Gard. Chron.* June 29, 1889, fig.

SYNONYM:—*T. Myristica*, Hook. *Bot. Mag.* t. 4780; *Gard. Chron.* Nov. 29, 1884; Veitch, l. c. 311.

Introduced from California by W. Lobb in 1851.

2. **T. grandis**, Fortune in Gordon *Pinetum*, p. 326; Parlatores, l. c. 505; Veitch, l. c. 311; Beissner, 185.

Introduced from the mountains of Northern China in 1847 by Fortune.

T. Humboldtii, Knight. See *Podocarpus taxifolia*.

T. montana. See *T. taxifolia*.

T. Myristica. See *T. californica*.

3. **T. nucifera**, Siebold and Zuccarini, *Flor. Japon.* ii. t. 129; Parlatores, l. c. 505; Veitch, l. c. 311; Beissner, 186.

Japan.

4. **T. taxifolia**, Arnott; Parlatores, 505; Hooker, *Icones*, t. 232, 233; Loudon, *Encycl.* p. 944, figs.; Veitch, l. c. 311; Hoopes, *Evergreens*, 387, f. 62; Beissner, 186, fig. 46.

Western Florida.

TSUGA, Carrière; Benth. et Hook. iii. 440; Eichler, 70. PINUS, sect. TSUGA, Endlicher; Parlatores (excl. syn. KETELEERIA). PICEA, sect. 2, Link. MICROPEUCE, Gordon. The Hemlock Spruces. HESPEROPEUCE, Lemmon. (Tribe ABETINEÆ.)

Evergreen trees, with flat or angular, stalked leaves proceeding from prominent cushions (as in Picea), generally spreading, distichous or apparently so, but erect and in many rows in *T. Pattoniana*. One resin canal runs through each leaf beneath the midrib. Buds scaly. Male flowers lateral. Stamens on stalked heads. Anthers crested, opening lengthwise. Pollen two-lobed (discoidal in *Pattoniana*, Engelmann). Seeds very small, wing obovate. Female cones terminal. Scales persistent, more or less woody.

T. Albertiana. See *T. Mertensiana*.

T. Balfouriana, McNab in *Journ. Linn. Soc.* xix. (1882) 211, ed. 1.

1. **T. Brunoniana**, Carrière, *Conif.* 188; Beissner, 397; Masters in *Gard. Chron.* Oct. 16, 1886; and J. D. Hooker, July 17, 1873, fig.

SYNONYMS:—*Pinus dumosa*, Don ; Parlature, l. c. 429 ; Lambert. *Pinus Brunoniana*, Wallich, *Plant. Asiat. Rar.* iii. t. 247. *Abies Brunoniana*, Lindley ; Veitch, 119. *Abies dumosa*, Loudon, *Arboretum*, iv. 2325 ; *Encycl. Trees*, 1036, f. 1937. *A. cedroides*, Griff. ex *Kew Index*.

Eastern and Central Hinnalaya. Introduced in 1838.

2. **T. canadensis**, Carrière, *Traité Conif.* 189 ; Beissner, 398, figs. 108, 109 ; Macoun, 471. The Hemlock Spruce.

SYNONYMS:—*Pinus canadensis*, Linnæus ; Lambert, *Pinus*, ed. 1, t. 32 ; Parlature, xvi. (2) 428. *Abies canadensis*, Desfontaines ; Loudon, *Encycl.* 1035, f. 1935 ; *Arboretum*, iv. 2322 ; Hoopes, *Evergreens*, 184, f. 23 ; Veitch, 114, f. 29, fig. *Picea canadensis*, Link. *Abies curvifolia*, Salisbury.

Var. **PARVIFOLIA**, Veitch, 115. Other varieties are :—**NANA**, **COMPACTA**, **GLOBOSA**, **GRACILIS**, **FASTIGIATA**, **COLUMNARIS**, **MACROPHYLLA**, **SPARSIFOLIA**, **MICROPHYLLA**, **PARVIFOLIA**, **PENDULA**, **AUREA**, **ALBO-SPICA**.

North-East America. Introduced by Peter Collinson in 1736.

3. **T. caroliniana**, Greene in Coulter *Botanical Gazette*, vi. 223 ; Beissner, 406, fig. 111 ; Sargent in *Gard. Chron.* Dec. 18, 1886, fig. ; *Census Report*, 207 ; *Garden and Forest*, June 5, 1889.

Mountains of North and of South Carolina.

4. **T. diversifolia**, Maximowicz ; Beissner, 396 ; Mayr, *Mon. Abiet. Japan.* 61, t. 4, f. 13 ; Masters, *Journ. Linn. Soc.* xviii. 512.

Japan. Introduced in 1878. It has the same leaf-structure as *T. Sieboldii*.

T. Douglasii. See *Pseudotsuga*.

T. Hanburyana = *T. Sieboldii*.

T. Hookeriana. See *T. Pattoniana*.

T. Lindleyana, Roehl. See *Pseudotsuga Douglasii*.

5. **T. Mertensiana**, Carrière, *Traité*, ed. 2, 250 ; Beissner, 403, fig. ; Lemmon, *Third Report*, Nos. 7, 8 ; *Gard. Chron.* Feb. 7, 1885 ; Macoun, 471. Western Hemlock.

SYNONYMS:—*Pinus Mertensiana*, Bongard ; Parlature, l. c. xvi. (2) 428. *Abies Mertensiana*, Lindley and Gordon, *Journ. Hort. Soc.* v. 211 ; Hoopes, *Evergreens*, 192. *Gard. Chron.* Feb. 7, 1885, p. 181, fig. 35. *Abies Albertiana*, Murray in *Proc. Hort. Soc. Lond.* iii. 149 ; Lawson, *Pinetum Britannicum*, part 12, t. 16 ; *Gard. Chron.* 1863, p. 340, fig. ; Veitch, 113.

Alaska, British Columbia, Oregon. Introduced by Jeffrey in 1851.

6. **T. Pattoniana**, Engelmann in *Gard. Chron.* April 4, 1882 ; *Bot. of California*, ii. 121 ; Beissner, l. c. 407, fig. 113 ; Macoun, 473 ; MacNab in *Journ. Linn. Soc.* xix. (1882) 211.

SYNONYMS:—*Abies Pattoniana*, Jeffrey ; Lawson, *Pinetum*, ii. 157, tab. 22 ; Hoopes, *Evergreens*, 172 ; Veitch, 116, f. 31, 32. *A.*

Hookeriana, Murray in *Pinet. Britan.* ii. 153, t. 21, 22; Veitch, 115. *A. Williamsoni*, Newberry. *Pinus Pattoniana*, Parlature, l. c. 429. *Hesperopeuke Pattoniana*, Lemmon, *Third Report*, fig. 9.

Some doubts still exist as to whether there are two distinct species, *Hookeriana* and *Pattoniana*, as MacNab states *loc. cit.*, or whether both form one species. The leaf-structure is essentially the same as in other *Tsugas*. The flat-leaved form with stomata on the lower surface only, grown in some gardens under this name (*Pattoniana*), is presumed by Engelmann to be a form of *T. Mertensiana*. See *Gard. Chron.* April 4, 1882. Engelmann and, recently on anatomical grounds, Van Tieghem consider *T. Pattoniana* as the representative of a separate section or even genus, having leaves almost tufted, not distichous, convex, keeled on the upper surface, acutish, stomatose on both sides; pollen grains bilobed; cones larger than in *Tsuga* proper; the scales recurved at the tips. Lemmon also makes the plant the representative of a distinct genus.

Fraser River to South California. Alpine tree.

7. **T. Roetzlii**, Carrière in *Rev. Hort.* (1870) 21; Nicholson, *Dict. of Gardening*, iv. p. 101, fig. Only known from Carrière's figure and description, and seems near to **T. Pattoniana**.

North California.

8. **T. Sieboldi**, Carrière, 186; Beissner, 395, fig.; Mayr, *Mon. Abiet. Japan.* 59, t. 4, f. 12.

SYNONYMS :—*Pinus Tsuga*, Antoine; Parlature, l. c. 428. *Abies Tsuga*, Siebold and Zuccarini, *Flor. Japan*, ii. t. 106; Veitch, 118, with fig.; Murray, *Pines and Firs of Japan*, p. 88.

VARIETY :—NANA.

Japan.

T. Williamsonii. See **T. Pattoniana**.

WELLINGTONIA. See **Sequoia**.

WIDDRINGTONIA, Endlicher; Parlature, 442. **PACHYLEPIS**, Brongniart. (Tribe **CUPRESSINEÆ**.)

A genus of South African trees, differing from the Australian *Callitris* which they much resemble in having spirally disposed leaves and numerous seeds to each scale of the cone.

The species named are **W. juniperoides**, **W. Commersoni** and **W. cupressoides**, representatives of which, or plants so named, are met with in Botanic gardens, under glass. Some forms of **RETINOSPORA** (which see) are also loosely called *Widdringtonias*. *W. glauca* of Gordon's *Herbarium* (MSS.) is *Fitzroya patagonica*.

Yew. See **TAXUS**.

Yew, Prince Albert's. See **SAXEGOTHEA**.

PINETUM DANICUM.

CONIFERS COLLECTED AND OBSERVED BY
PROFESSOR CARL HANSEN, Mynstersvei 2, Copenhagen, V.

NOTES SENT TO THE CONIFER CONFERENCE HELD AT CHISWICK,
OCTOBER, 1891.

SYNOPSIS OF THE NATURAL ORDER CONIFERÆ.

CONIFERÆ.

THE Conifers (cone-bearers) are a most important family of the vegetable kingdom. They form, together with the Gnetaceæ and Cycadeæ, the "Gymnosperms," or naked-seeded plants, as the ovule is naked, in pairs, or several, on the face of the ovary, inverted, and consisting of one or two membranes open at the apex, together with a nucleus; or the ovules are also naked, and then (as in the Taxaceæ) the foramen is at their apex, their outer skin becoming finally hard. And then, in this case, the seed is usually supported or surrounded by a succulent imperfect cup-shaped pericarp. In other cases the fruit consists of a cone formed of the scale-like ovaries having become enlarged and hardened, and occasionally of the bracts also, which are sometimes obliterated, and sometimes extend beyond the scales in the form of a lobed appendage. Seed furnished with a hard crustaceous integument.

The plants abound in resinous wood, with the ligneous tissue marked with circular discs.

SERIES A.

Ovules erect during the period of flowering.

TRIBE I.—CUPRESSINEÆ.

The scales of the cones are in two or more rows opposite each other, or verticillate in three or four whorls; the cones of some

genera have a few valvate or peltate scales on a depressed axis. Ovules erect, two or more, seldom one.

Among the Cupressineæ we rarely find lofty trees as under Abietineæ. The Cupressineæ are all evergreen (the "deciduous Cypress," *Taxodium distichum*, which in former days was termed a Cupressus, does not belong to this tribe, but to the Taxodiæ), and none of them have the leaves arranged in whorls, as is the case with the Pines. A greater part of the species are natives of warm climates, and of the genus Cupressus itself only a few species are really hardy in Northern Europe. The common Juniper alone is indigenous to Northern Europe.

1. *CALLITRIS*, Vent. : including
 - (a) *FRENELA*, Mirb.;
 - (b) *WIDDRINGTONIA*, Endl.
2. *ACTINOSTROBUS*, Miq.
3. *FITZROYA*, Hook. fil.
4. *LIBOCEDRUS*, Endl.
5. *THUYA*, Tourn. : including
 - (a) *EUTHUYA*, Benth. et Hook.;
 - (b) *MACROTHUYA*, Benth. et Hook.
6. *THUYOPSIS*, Sieb. et Zucc.
7. *BIOTA*, Endl.
8. *CHAMÆCYPARIS*, Spach.
9. *CUPRESSUS*, Tourn.
10. *JUNIPERUS*, L. : including
 - (a) *SABINA*, Endl.;
 - (b) *OXYCEDRUS*, Endl.;
 - (c) *CARYOCEDRUS*, Endl.

TRIBE II.—*TAXODIÆ*.

Flowers monœcious. Anthers 2- to 5-celled, opening lengthwise. Cones with scales spirally arranged. Ovules 2 to 6, erect; under the fruit scales in one or two genera, more or less curved. Leaves spirally placed or distichous. The seed scale fixed to the bract.

Large trees with evergreen or deciduous leaves. The plants of this tribe are chiefly natives of North America, Japan, North China, Tasmania, and Australia.

11. *CRYPTOMERIA*, Don.
12. *TAXODIUM*, Rich.
13. *GLYPTOSTROBUS*, Endl.
14. *SEQUOIA*, Endl. (*Wellingtonia*, Lindl.)
15. *ATHROTAXIS*, Don. (*Arthrotaxis*, Endl.)

TRIBE III.—*TAXEÆ*.

Some authors consider this tribe to be itself a natural order distinct from Coniferæ.

Flowers unisexual, mostly axillary, diœcious, *i.e.* male and female flowers appearing on different plants. The male flower consists of anthers on short pedicels inserted on all parts of the axis. Filaments short, prolonged in a peltate or squamiform connective, and bearing 2, 4, or 8 cells, which open longitudinally. Female flowers naked, solitary, or rarely two under each bract. Ovule solitary, erect, sessile on the centre of the disc.

Fruit always monospermous, more or less drupaceous, ripening once or twice a year. Embryo with two cotyledons.

Of the plants belonging to this tribe, the *Taxus* (of which some authors have made two species, others eight, others again only one) is spread through the temperate regions of the Northern Hemisphere. Other genera are found in Japan, China, Tasmania, New Zealand, and Borneo.

16. *TAXUS*, *Tourn.*
17. *CEPHALOTAXUS*, *Sieb. et Zucc.*
18. *TORREYA*, *Arn.*
19. *GINKGO*, *Kæmpf.*
20. *PHYLLOCLADUS*, *Rich.*

SERIES B.

Ovules somewhat curved during flowering period.

TRIBE IV.—*PODOCARPEÆ*.

Tall evergreen trees, sometimes even gigantic, more rarely shrubs.

Leaves persistent, alternate, spreading or sub-opposite; flat, linear, or almost ovate-elliptic, sometimes dimorphic, some of them aciculate, spreading, others squamiform, imbricate, with or without ribs; sessile or sub-petiolate, occasionally having on the underside (rarely on both sides) some lines of stomata. Shoots naked or with scales.

Flowers diœcious, or more often monœcious on different twigs. The male flowers imbricated around one common axis, and thus

forming terminal clusters. The male catkins ovoid, short, terminating the small twigs or springing out near the leaves or shoots, solitary or clustered, cylindrical, thick or filiform. The female catkins are sometimes solitary at the points of the small branches, sometimes arranged otherwise, the bracts forming a receptacle or fleshy body.

Seed inverted, sometimes fleshy, sometimes thin and very soft.

Embryo placed on the summit of the farinaceous albumen; cotyledons two, semi-cylindrical, radicle obtuse.

Natives of the temperate regions of Asia, Africa, America, and Australia.

21. *DACRYDIUM*, *Sol.*
22. *MICROCACHRYS*, *Hook. fil.*
23. *SAXE-GOTHÆA*, *Lindl.*
24. *PODOCARPUS*, *L'Her.* : including
 - (a) *NAGÆIA*, *Gaertner* (as genus) ;
 - (b) *EUPODOCARPUS*, *Endl.* ;
 - (c) *STACHYCARPUS*, *Endl.* ;
 - (d) *DACRYCARPUS*, *Endl.*
25. *PRUMNOPITYS*, *Phil.*

TRIBE V.—*ARAUCARIÆÆ*.

Large trees in their natural habitats in somewhat warm, more seldom in temperate climates in both hemispheres. Leaves alternate, rarely sub-opposite, acicular, tetragonous, recurved or flat, acuminate, sub-elliptic. Ovuliferous scales monospermic, inserted around the central axis, forming when mature subglobose cones. Anthers multilocular. Seed solitary, under each scale, free or almost free and pendent.

Embryo with 2 to 4 cotyledons.

Natives of South America, Australia, Malayan Archipelago, China, and Japan.

26. *CUNNINGHAMIA*, *R. Br.*
27. *DAMMARA*, *Lamb.* (*Agathis*, *Salisb.*)
28. *ARAUCARIA*, *Juss.* : including
 - (a) *COLUMBEA*, *Salisb.* ;
 - (b) *EUTACTA*, *Link.*
29. *SCIADOPITYS*, *Sieb. et Zucc.*

TRIBE VI.—*ABIETINEÆ*.

Mostly large evergreen trees.

Leaves persistent, very seldom deciduous, acicular or narrowly linear, single or two or more in a fascicle.

Flowers monœcious. Ovuliferous scales imbricate, situate around one common axis, forming terminal or lateral catkins, erect or pendent.

Seeds two under each scale, free.

Embryo solitary, rarely several in the same seed; amphitropous in the axis of the fleshy albumen, and of the same length.

Cotyledons 3 to 18.

The different genera are found in many parts of Europe, Asia, North Africa, North America, but not in Australia or Central and South Africa, or in South America.

30. *PINUS*, *L.* : including

(a) *PINASTER*, *Endl.* = *Binæ* (two leaves) ;

(b) *TÆDA*, *Endl.* = *Ternæ* (three leaves) ;

(c) *CEMBRA*, *Spach* = *Quinæ* (five leaves) ;

(d) *STROBUS*, *Spach* = *Quinæ* (five leaves).

31. *CEDRUS*, *Link.*32. *PSEUDOLARIX*, *Gord.*33. *LARIX*, *Link.*34. *PICEA*, *Link.* : including

(a) *EUPICEA*, *Willk.* ;

(b) *OMORICA*, *Willk.*

35. *TSUGA*, *Carr.* : including

(a) *EUTSUGA*, *Engelm.* ;

(b) *HESPEROPEUCE*, *Engelm.*

36. *PSEUDOTSUGA*, *Carr.*37. *KETELEERIA*, *Carr.*38. *ABIES*, *Link.*

SERIES A.

TRIBE I.—*CUPRESSINEÆ*.

1. *CALLITRIS*.—Vent. Decad. 1808, except spec. Nov. Holl. ; Spach, Hist. Natur. des Végét. Phanér. vol. xi. p. 342 ; Rich. Conif. p. 64, t. 8, fig. 1, except spec. ; Brongn. in Ann. Sc. Nat. vol. xxx. p. 189, except spec. ; Endl. Gen. Pl. p. 259, n. 1792, except spec., and Syn. Conif. p. 40 ; Carrière, Conif. p. 80 ; Gord. Pin. p. 37 ; Henkel and Hochstetter, Synopsis der Nadelhölzer, 1869, p. 290 ; Thuya

spec., Vahl, Symb. Bot. ii. p. 96, t. 48 ; Desf. Fl. Atl. 2, p. 353, t. 252 ; Frenela sp., Mirbel in Mém. du Mus. vol. xiii. p. 74 ; J. E. Nelson, Pinac. 68 ; Parl. in D. C. Prodr. xvi. 2, 452 ; Carr. Traité Gén. des Conif. 1867, p. 63 ; Beissner, Nadelholzk. 7.

Flowers monœcious (or male and female on the same plant), but separate and terminal ; the male catkins globular or semi-cylindrical ; female on side branches, solitary.

Cones globular or somewhat four-sided, and composed of four-valved woody scales, the alternate pair much the smaller ; valves or scales in opposite pairs, regularly truncated on the top, and four in number.

Seeds one or two at the base of each scale or valve, the larger pair of scales having two seeds each, the smaller pair but one under each ; seeds winged on each side, slightly compressed, and somewhat three-edged.

Cotyledons from three to six, but mostly in fours ; sometimes two. The young root grows above ground.

Leaves very small, trapeziform (epigeal), in decussate opposite pairs, close together at the base of the joints.

Name derived from *kallos*, beauty, from the elegant and regular appearance of the jointed branchlets.

The African species—the only one about which most botanists agree that it is a real *Callitris*—is not hardy in Northern Europe. It has sometimes been cultivated out of doors near the Channel, but attains its best development near the Mediterranean Sea. The Australian species are by many authors deemed to be *Frenelas*, and in Europe are seldom found outside greenhouses.

(i) *C. quadrivalvis*, Ventenat. Nov. Gen. Decad. 10 ; Rich. Conif. 46, t. 8, f. 1 ; Loud. Encycl. of Trees, 1072, f. 1995 ; Spach, Hist. Vég. Phan. xi. 344 ; Endl. Syn. Conif. 41 ; Lindl. et Gord. Journ. Hort. Soc. v. 204 ; Knight, Syn. Conif. 14 ; Carr. Man. des Pl. iv. 320 ; Carr. Tr. Gén. Conif. ed. 1, 81 ; ed. 2, 1867, p. 87 ; Gord. Pinet. 38 (excl. *Thuya inæqualis*). *Juniperus Sandaracca*, Linn. *Cupressus fructu quadrivalvi, foliis Equisetis, ad instar articulatis*, Shaw, Afr. No. 79 (cum ic.). *Thuya articulata*, Vahl. Symb. ii. 96, t. 48 ; Desf. Flor. Atl. ii. 353, t. 252 ; Hist. Arbr. ii. 576 ; Loisel. Nouv. Duham. iii. 15, t. 5. *Frenela Fontanesii*, Mirb. Mém. Mus. xiii. 74. *Cupressus articulata*, Forb. Pinet. Wob. 191.

Habitat.—Different parts of northern Africa ; hills and mountains of the Barbary States. Wintered in Denmark in a frame or greenhouse.

The trees of *C. quadrivalvis*, seen by Desfontaines in Algiers, were only from 15 feet to 20 feet high, but Broussonet states that he had seen larger ones in the kingdom of Morocco.

In the empire of Morocco, according to Broussonet, this tree produces the gum sandarach of commerce. This substance is in tears, clear, shining, diaphanous, of a whitish yellow, and free from impurities.

Dissolved in spirit of wine, it produces a clear delicate varnish, easily scratched ; reduced to a fine powder, it forms a very superior kind of pounce, and is applied to paper and parchment to make them bear ink. It was for a long time thought that gum sandarach was obtained from some species of Juniper. Captain S. E. Cook, in his "Sketches in Spain," vol. ii., has brought to light the interesting fact that the wood-work of the roof of the celebrated mosque, now the Cathedral of Cordova, which was built in the ninth century, is made of the wood of this tree. It had been previously thought to be that of the larch, from the resemblance of the Spanish word *alerce*—which is applied to the wood of *Callitris quadrivalvis* in Spain and Barbary—to the Latin word *larix*, whence the English word *larch*. The larch, however, is not found in any part of Spain. After carefully examining the wood in question, and comparing it with the timber of the roofs of the Alhambra and the Alcazar, the roofs of which are of *Pinus Pinea*, or Stone Pine, once extensively grown in Andalusia, Captain Cook came to the conclusion that the origin of the timber of the mosque must be sought elsewhere, and that it was not of any Spanish, or even European, tree. By a singular coincidence, the subject had been undergoing investigation about the same time in Africa. Mr. Drummond Hay, the British consul at Tangier, had, by tracing the Arabic etymology of the word *alerce*, by availing himself of the extensive botanical researches of the late Mr. Schousboe, the Danish consul in Morocco, and by collating the accounts of the resident Moors, made out that the *alerce* was the *Thuja articulata*, Desf. (*Callitris quadrivalvis*, Vent.), which grows on Mount Atlas, in the vicinity of Tangier.

(a) FRENELA, Mirb. Mém. Mus. xiii. 30 (except sp. *atlant.*) ; Spach, Hist. des Vég. Phanér. xi. 345 ; Endl. Conif. p. 35 ; Carr. Conif. p. 68 ; Hook. fil. Flor. of Tasmania, p. 351 ; Gord. Pin. p. 82. *Callitris*, Vent. Nov. Gen., Dec. 1808 ; Rich. Conif. pp. 47–49, tab. 18, n. 1 and 2 (except sp. *atlant.*). *Leichhardtia*, Shepherd, Catal. of Plants cultivated at Sydney, p. 15 (not R. Brown). *Octoclinis*, Ferd. Muell. in Trans. of the Philosoph. Inst. of Victoria, ii. 20, m. Apl. ; Parl. in D. C. Prodr. xvi., ii. 445 ; Henk. and Hochst. Syn. der Nadelh. 298 ; Carr. Tr. Gén. Conif. ed. 2, 1867, p. 63 ; Beissner, Nadelholzk. 7.

Flowers monœcious.

Cones nearly globular or conical, and consisting of six or rarely eight valved scales, the alternate ones being much the smaller and shorter.

Seeds numerous, more or less angular, and laterally winged on both sides.

Leaves mostly ternate, scale-formed, and decurrent.

Cotyledons three.

All trees or shrubs, natives of New Holland, and not hardy.

Named after M. Frenel by Professor Mirbel of Paris.

F. australis, Mirb. Mém. Mus. xiii. 74; Endl. Syn. Conif. 37; Lindl. and Gord. Journ. Hort. Soc. v. 203; Knight, Syn. Conif. 14; Carr. Man. des Pl. iv. 318; Carr. Tr. Gén. Conif. 71; Gord. Pinet. 83 (excl. syn. *Cham. glauca*); Hook. fil. Flor. of Tasm. i. 352, pl. 97; Carr. Tr. Gén. Conif. ed. 2, 67. *Thuya australis*, Desf. Hort. Par. 274; Poir. Encycl. suppl. v. 302. *Cupressus australis*, Pers. Syn. ii. 580 (not Desf.). *Callitris australis*, R. Br. Mss.; Hook. Lond. Journ. of Bot. iv. 147. *Thuya inæqualis*, Desf. Cat. Hort. Par. ed. 3, 274.

Habitat.—New Holland and Tasmania. Has been wintered in a frame and indoors. Oyster Bay Pine.

F. Hugelii, hort. *Callitris Hugelii*, Herb. Mus. Par.; Knight, Syn. Conif. 14. Carr. Tr. Gén. Conif. 73 (*pro parte*); Gord. Pinet. 85 (*pro parte*).

Habitat.—New Holland. Introduced to Europe about 1824. Wintered indoors.

(b) **WIDDRINGTONIA**, Endl. Cat. Hort. Vindob. i. 209, and Conif. 31; Carr. Conif. 63; Gord. Pin. 332. *Thuya* sp. Linn. Mant. 125. *Cupressi* sp. Mill. Dict. n. 6. *Juniperi* sp. Lam. Dict. ii. 626. *Schubertia* sp. Spreng. Syst. Veg. iii. 890. *Pachylepis*, Brongn. in Ann. des Scienc. Nat. ser. 1, xxx. 189; Spach, Hist. des Vég. Phanér. xi. 346; Endl. Gen. Pl. 259 and 1793 (not Less.). *Parolinia*, Endl. Gen. Pl. suppl. i. 1372 and 1793; Endl. Cat. Hort. Vindob. i. 209, and Syn. Conif. 31; Carr. Conif. 57; Gord. Pin. 332; Parl. in D. C. Prod. xvi., 2, 442; Henkel and Hochstetter, Syn. der Nadelh. 292.

Flowers dioecious (or male and female on separate plants), and terminal; the male catkins oblong or cylindrical; the female ones globular, and with footstalks.

Cones globular, either solitary or two or three together, and composed of four valves or scales.

Scales, or valves, four in number, oval, mucronate, somewhat in whorls round a depressed axis, with the edges converging.

Seeds frequently few from abortion, but with from five to ten ovules at the base of each scale, in one or two series, and covered with a somewhat crustaceous tegument, spreading on each side into a membranaceous wing.

Cotyledons two.

Leaves thickly set, alternately or in whorls, linear or needle-shaped, spreading, but sometimes very small, scale-like and subimbricate, with a gland on the back.

Named in compliment to Captain Widdrington (formerly Cook), who travelled in Spain. All evergreen bushes or small trees, found at the Cape of Good Hope and Madagascar. They seem to be rare in cultivation.

W. cupressoides, Endl. Cat. Hort. Vindob. i. 209; Syn. Conif. 33; Lindl. and Gord. Journ. Hort. Soc. v. 203; Knight, Syn. Conif. 13; Carr. Man. des Pl. vi. 317, and Tr. Gén. Conif. 66; Gord. Pinet. 333. *Thuja cupressoides*, Linn. Mantis. 125; Thunb. Fl. Cap. (ed. Schult.) 500; Loud. Arbor. iv. 2460, f. 2316. *Thuja aphylla*, Burm. Prodr. 27. *Callitris cupressoides*, Schrad. Mss. Herb. Dreg.; E. Mey. Pflanzengeogr. Dokum. 126, 170. *Callitris stricta*, Schrad. Mss. *Pachylepis cupressoides*, Brongn. Ann. Sc. Nat. ser. 1, xxx. 190.

Habitat.—All the species, except *W. Commersonii*, Endl., which inhabits Madagascar, live in South Africa. *W. cupressoides* is to be found in the west of that land. It was introduced to Europe in 1756.

The plant under my observation is perhaps wrongly named. It seems as if various genera are in commerce under the name of Widdringtonia.

2. ACTINOSTROBUS, Miquel, Enumeratio, Plant. Preiss. i. 644; Endl. Syn. Conif. 39; Carr. Man. des Pl. iv. 319, and Tr. Gén. Conif. 77; Gord. Pinet. 20; Henk. and Hochst. Syn. der Nadelh. 305; Carr. Tr. Gén. des Conif. ed. 2, 77. *Actinostrobus* (*partim*), J. E. Nelson, Pinac. 58; Parl. in D. C. Prodr. xvi. 2, 444; Eichler in Engl. and Prantl. Natürl. Pflf.; Benth. Fl. Austr. vi. 239.

Flowers monœcious (or male and female on the same plant, but on different branches), separate and terminal; the male catkins egg-shaped, or somewhat globular, the female ones solitary and globular.

Cones somewhat globular, solitary, and composed of six scales, disposed in two vertical sets at the base, and woody. Valves or scales convex on the back; those at the base much the shortest, with the interior ones much the largest.

Seeds in twos, under each of the upper scales, three-edged, and winged on each side.

Cotyledons two. The young root grows a little overground.

Leaves persistent, scale-like, very small, in whorls of three, stiff, and acuminate.

Name derived from *ἀκρίς* (*aktis*), a ray, and *στέβος* (*strobos*), a cone; the scales radiated.

Pyramidal bushes, found on the south-west coast of New Holland.

It seems as if only one species is cultivated in Europe. It is sometimes enumerated in the seed catalogues from France and other southern countries, where it has fruited. Cultivated in conservatories.

A. pyramidalis, Miq. Enum. Pl. Preiss. i. 644; Fl. Serr. v. 501b (*cum ic.*); Endl. Syn. Conif. 39; Lindl. and Gord. Journ. Hort. Soc. v. 204; Carr. Man. des Pl. iv. 319, and Tr. Gén. Conif. 78; Gord. Pinet. 20.

Habitat.—New Holland, along the Swan River. Introduced to Europe in 1838. Wintered in a frame,

3. FITZROYA.—Hook. fil. in Herb. Hook. and in Bot. Mag. t. 4616 ; Lindl. in Paxton's Flower Garden, ii. 115, no. 387 ; Cl. Gay, Fl. Chil. v. 410 ; Carr. Conif. 108 and 115 ; Gord. Pinet. 81 ; Parl. in D. C. Prodr. xvi. 2, 463 ; Lemaire, Illustr. Hort. i. Misc. 30, *cum ic.* ; Fl. des Serres, vii. 130 ; Eichler in Engl. and Prantl. Nat. Pfl. ii. p. 95 ; Beissner, Nadelholzk. 8.

Flowers dioecious, or male and female on separate plants.

Cones star-like bodies, having their axis terminating in three soft clublike glands or abortive scales, and consisting of nine scales, three in each whorl.

Scales nine in number, in whorls of three, the lower three alternate with the upper leaves ; the intermediate three only are fertile, the upper three are alternating, with the fertile ones flattened and standing with their edges bent outwards.

Seeds three under each fertile scale, surrounded by a broad wing, ending in a narrow neck, the centre seed attached to the scale, the other two to the axil, but sometimes two seeds are on the scale, and three on the axil (Hooker).

Leaves in whorls of three, but sometimes in twos or fours, ovate-oblong, flat, without any footstalks, and more or less spreading or loosely imbricated.

Named by Dr. Hooker, in compliment to Captain Fitzroy, who first discovered the tree.

A large evergreen tree, found almost exclusively on the Patagonian mountains.

F. patagonica, Hook. fil. in Bot. Mag. t. 4616 ; Lindl. in Paxt. Flow. Gard. ii. 115, no. 387 ; Fl. Serr. vii. 129 ; Lindl. Journ. Hort. Soc. vi. 264 ; Ch. Lem. Illustr. 1854, p. 29, *cum ic.* ; Cl. Gay, Fl. Chil. v. 411 ; Carr. Man. des Pl. iv. 323 ; Carr. Tr. Gén. Conif. 109 ; Gord. Pinet. 81 ; Henkel and Hochstetter, 295. *Cuprestellata patagonica*, J. E. Nelson, *l.c.*

Habitat.—South-south-western South America, Patagonia to Magellan.

Introduced in 1851 by Lobb.

A planted-out specimen died in the winter of 1890-91, but I fear we had covered it too much.

The plant was first discovered by Captain Fitzroy on the South Pole expedition with "The Beagle" (1831-36). According to Philippi, in Petermann's Mittheilungen, 1860, p. 133, it is this species which yields the Alerce timber, so esteemed on the west coast of South America ; other authors say it is obtained from *Libocedrus tetragona*.

A section of a plank of Fitzroya brought home by William Lobb, and preserved in the museum of Messrs. Veitch & Sons' Nursery, shows that the wood is of a reddish colour, straight, and fine in grain, and susceptible of a high polish. The section contains 260 cubic inches, and weighs 85 ounces, or about 3 cubic inches to the

ounce. A similar section of a plank of *Libocedrus tetragona*, of precisely the same size, is found to be of the same weight (Veitch).

4. LIBOCEDRUS.—Endl. Conif. 42; Cl. Gay, Flor. Chil. v. 405; Carr. Conif. 84; Gord. Pin. 131. *Dacrydii* sp. Don aft. Endl. *Juniperi* sp. Lamb. Pin. ed. 2, 116. *Thuya* sp. Hook. Lond. Journ. of Bot. i. 571, ii. 199, and iii. 144; Poepp. Nov. Gen. et Sp. iii. 17; Gord. Pin. 321; Henkel and Hochstetter, Syn. Nadelh. 282; Carr. Tr. Gén. Conif. ed. 2, 85; Parl. in D. C. Prodr. xvi. 2, 453; Brongn. and Gris. in Bull. Soc. Bot. Tr. xviii. 140; Eichler in Engl. and Prantl. Natürl. Pfl. ii. s. 95; Hoopes, Evergreens, 309, f. 40; Watson in King's Rep. v. 335; Bot. California, ii. 116; A. Murray in London Garden, ii. 542; Veitch, Manual Conif. 267; Beissner, Nadelholzk. 8, 27.

Flowers monœcious, or male and female on the same plant, but separate and terminal on different branches. Male catkins almost cylindrical; female ones solitary and globular.

Cones oval, more or less obtuse, woody, and composed of from four to six scales, which are flat, or slightly concave on the inner face.

Scales in opposite pairs, face to face, and not overlapping; the lower ones small and mostly abortive; the whole of them furnished with a terminal small incurved point below the apex, and leathery in texture.

Seeds singly or in twos under each scale, the upper or larger scales having each two seeds at the base, while the two lower or smaller ones are either abortive or have but one seed each. Seeds unequally two-winged.

Cotyledons two.

Leaves scale-formed, compressed in opposite pairs, and in four imbricated rows, the under and the upper ones much the smallest.

Name derived from *libanos*, incense, and *Cedrus*, the Cedar.

All large evergreen trees, found in California, Chili, New Zealand, New Guinea and China.

L. chilensis, Endlicher, Syn. Conif. 44; Lindl. and Gord. Journ. Hort. Soc. v. 205; Knight, Syn. Conif. 15; Cl. Gay, Fl. Chil. v. 406; Carr. Man. des Pl. iv. 321, and Tr. Gén. Conif. 89; Gord. Pinet. 131, and suppl. 41. *Thuya carneata*, Domb. Mss. Herb. Mus. Par. *Cupressus thyoides*, Pav. Mss. (not Linn.). *Thuya andina*, Poepp. Nov. Gen. et Spec. iii. 17, t. 220. *Thuya chilensis*, Don in Lamb. Pin. ed. 2, iii. 114; Loud. Encycl. of Trees, 1070; Hook. Lond. Journ. of Bot. ii. 199, t. 4; Spach, Hist. Vég. Phan. xi. 342. *Cupressus chilensis*, Gillies, ex. Gord. l.c.

Has kept alive several years out of doors, sparingly covered. It seems somewhat hardy, and the varieties are perhaps the same.

L. c. argentea. A variety lighter coloured than the species.

Habitat.—Southern Chili; common on the cool slopes of the lower Cordilleras of the Andes, near Castillo de Tivun-Leuvu, from latitude 34° S. to Valdivia, the volcanic mountains of Antuco, as also the lagunes of Rauco.

Introduced in 1847 by Messrs. Hugh Low & Co., of Clapton (*Gardeners' Chronicle*, 1850, p. 439).

L. decurrens, Torr. Pl. Fremont, 7, t. 3. *Thuja gigantea*, Carr. Conif. 112. *Thuja Craigiana*, Murray in Rep. Oreg. Exped. 2, t. 5. *Libocedrus Craigiana*, Laws. ex. Gord. Pinet. suppl. 103. *Heyderia decurrens*, C. Koch, Dendr. ii. 179. *Calocedrus californica*, Kurz.

North fork of the Santian River, Oregon, south along the western slopes of the Cascade and Sierra Nevada Mountains between 3,000 and 8,500 feet elevation, and through the California coast ranges to the San Bernardino and Cayumaca Mountains.

Introduced into Europe in 1854.

A large tree, 100–150 feet in height, with a trunk 4–8 feet in diameter; slopes and valleys; common. Wood light, soft, not strong, brittle, close-grained, compact, very durable in contact with the soil; bands of small summer cells thin, dark-coloured, conspicuous; medullary rays numerous, obscure; the thin sapwood nearly white; specific gravity, 0·4017; ash, 0·08; largely used for fencing and in the construction of water-flumes, and for interior finish, furniture, laths, shingles, &c.; often injured by a species of dry rot (*Dædalia vorax*, Harkness in *Pacific Rural Press*, Jan. 25, 1879, f. 1, 2), rendering it unfit for lumber (Ch. S. Sargent).

In some Danish gardens plants of *L. decurrens*, 30 years old, are about 30 feet high. One specimen, lately measured, has attained a height of 20 feet and a girth of 2 feet. It was planted in 1870.

The plant is often introduced under the wrong name of *Thuja gigantea*, which it still retains in foreign nurseries. It is hardy here. In the winter of 1890–91 only a few plants suffered a little. From Berlin was reported in the *Gartenflora* that not one plant was living in nurseries, &c. Our climate is milder in Denmark.

L. d. compacta, hort. A variety not growing so tall as the species, and much more branched.

L. d. glauca, hort. *Thuja decurrens glauca*, hort. A very nice bluish variety.

L. Doniana, Endlicher, Syn. Conif. 43; Lindl. and Gord. Journ. Hort. Soc. v. 205; Knight, Syn. Conif. 15; Carr. Man. des Pl. iv. 320; Tr. Gén. Conif. 85, and Rev. Hort. 1866, 230; Gord. Pinet. 132. *Dacrydium plumosum*, Don in Lamb. Pin. ed. 2, append. 143. *Thuja Doniana*, Hook. Lond. Journ. of Bot. i. 571, t. 18, and Flor. New. Zeal. 231, 232.

Habitat.—New Zealand, northern island; also on the mountain slopes in the neighbourhood of Nelson, at 6,000 feet elevation.

Introduced about the year 1848.

Wintered indoors. Large plants are here and there used for decorative purposes.

L. tetragona, Endl. Syn. Conif. 44 (excl. syn. *Juniperus uvifera*) ; Knight, Syn. Conif. 15 (excl. syn. *J. uvifera*) ; Paxt. Flow. Gard. i. 46, f. 32 ; C. Gay, Fl. Chil. v. 407 ; Carr. Man. des Pl. iv. 320, and Tr. Gén. Conif. 87 (excl. syn. *T. uvifera*) ; R. A. Philippi, Pl. Chil. n. 711 ; Henk. and Hochst. Syn. der Nadelh. 285 (excl. *J. uvifera*). Alerse or Alerze, King, Beagle, i. 182 ; C. Gay, l.c. *Pinus cupressoides*, Molin. Chil. 316. *Thuya tetragona*, Hook. Journ. of Bot. iii. 148, t. 4.

Habitat.—From Chili to Magellan.

Introduced in 1863.

Rare. Wintered indoors.

Libocedrus tetragona is, according to some authors, the Alerze of the Chilians, by whom it is justly valued as one of the most important timber trees of their country. The wood is almost indestructible by the weather, boards and shingles that have been exposed for upwards of one hundred years being worn quite thin, but remaining perfectly sound. It is reddish in colour, soft, easy to work, and useful for every description of carpentry. Alerze timber is exported in considerable quantities from Valdivia and Chiloe to the various ports along the Pacific coast of South America. From the fibrous inner bark is obtained a kind of tow, imperishable in water, which is much used by the seafaring people of Chiloe and the adjacent coast for making the joints of their skiffs and small craft water-tight. "De la corteza filamentosa se obtiene una estopa incorruptible dentro del agua, y que la gente del pais utiliza con mucha ventaja para tapar las junturas de sus piraguas" (C. Gay, "Victorie del Chile," 108).

5. THUYA.—Tourn. Inst. 586, t. 358 ; Linn. Gen. n. 1079, except spec. ; Juss. Gen. 413 ; Endl. Gen. Pl. 258, n. 1790, and Conif. 50 ; Spach, Hist. des Vég. Phanér. xi. 337 ; Carr. Conif. ed. 1, 101, ed. 2, 165. *Thuya* species, Gord. Pin. 321 ; L. C. Rich. Conif. t. 7, f. 1 ; Mich. N. Am. Sylv. t. 156 ; Wats. Dendrol. Brit. t. 150 ; Nees. Gen. Fl. Germ. Monochl. n. 11 ; E. Hall in Coulter's Bot. Gazette, ii. 91 ; G. M. Dawson in Canadian Nat. new ser. ; T. Howell in Coulter's Bot. Gazette, vi. ; Hoopes, Evergreens, 317 ; Vasey, Cat. Forest Trees, 36 ; Veitch, Manual Conif. 261 ; Bell in Geological Rep. Canada, 1879-80, 47c ; Beissner, Nadelholzk. 9, 32.

Flowers monœcious, the male catkins oval, the female ones solitary and terminal.

Cones ovate-oblong, solitary, terminal, leathery, and smooth, with a projecting tubercle below the apex of each scale.

Scales valvate, from six to ten in number, in opposite pairs, and mostly unequal in size.

Seeds in twos at the base of each scale, and furnished with a transparent wing, emarginate at the end.

Cotyledons two.

Leaves in opposite pairs, very small, scale-like, imbricated, compressed, and in four rows.

The name *Thuya* is derived from "Thyon" (sacrifice), in consequence of the twigs and resin being formerly used in the East instead of incense in sacrifices. The common English name, Arborvitæ (tree of life), is derived from its Chinese and Japanese ones. In Japan it is called "Hiba" (tree of life), and in China "Hak" (everlasting life), on account of the plants being evergreen, and of a lively or bright green at all seasons of the year. But as the genus *Thuya* is now defined, only one of the Chinese or Japanese kinds belongs to it, all the others being transferred to that of *Biota*.

Of the section *Euthuya* (Benth. and Hook.) one species is from eastern North America, and one from the western parts of that continent. Of the section *Macrothuya* (Benth. and Hook.) only one species is from North America from western parts, and another species strictly belongs to Japan.

T. gigantea, Nutt. Pl. of Rock. Mount. 52, and North Amer. Sylv. iii. 132, t. 111. *Thuya plicata*, Lamb. Pin. ed. 2, 114 (not Don). *Thuya Menziesii*, Dougl. Carr. Conif. 107. *Thuya Douglasii*, Nutt. Mss. *Thuya Lobbii*, hort. *Thuya occidentalis*, var. *plicata*, hort. ; Hoopes, Evergreens, 321 ; Veitch, Man. 256.

Habitat.—Alaska, south along the coast ranges and islands of British Columbia, through western Washington Territory and Oregon, and the coast ranges of Northern California to Mendocina County, extending east along the mountains of Washington Territory to the Cœur d'Alène, Bitter Root, and Salmon River Mountains of Idaho and the western slopes of the Rocky Mountains of Northern Montana (Canby and Sargent).

A large tree, 100–150 feet in height, with a trunk $2\frac{1}{2}$ – $11\frac{1}{2}$ feet in diameter ; low, rich woods and swamps, less commonly on dry ridges and slopes below 5,200 feet elevation ; common, and reaching its greatest development in western Washington Territory and Oregon ; the large specimens generally hollow.

Wood very light, soft, not strong, brittle, rather coarse-grained, compact, easily worked, very durable in contact with the soil ; bands of small summer cells thin, dark-coloured, distinct ; medullary rays numerous, obscure ; colour dull brown tinged with red, the thin sapwood nearly white ; specific gravity, 0.3796 ; ash, 0.17 ; largely used for interior finish, fencing, shingles, in cabinet-making and cooperage, and exclusively by the Indians of the north-west coast in the manufacture of their canoes (Ch. S. Sargent).

Thuya gigantea is described under the name of *T. Lobbii* by some

writers, and *T. Menziesii* by others. By Carrière and Hochstetter the *Libocedrus decurrens* of Torrey is described under the name of *Thuya gigantea*. There is, therefore, a confusion in the nomenclature of the two species, which it is very desirable should be got rid of. It originated in this manner: "A few years previous to the introduction of *T. Lobbii* to British gardens, Nuttall, an American botanist, published his 'Plants of the Rocky Mountains.' At page 52 of that work a *Thuya* is described under the name of *T. gigantea*, which some refer to *T. Lobbii*, and others to the *Libocedrus decurrens* of Torrey, discovered during the overland expedition to California conducted by Colonel Fremont in 1843 or 1844. The *Libocedrus* was first received in Great Britain by the Scotch Oregon Association, through their collector, John Jeffrey, without a name, a few months earlier than the *Thuya* was received by Veitch at the Exeter nursery from William Lobb. The Oregon Committee named Jeffrey's tree *T. Craigiana*, in compliment to Sir William Gibson Craig, one of their members, Torrey's designation being at that time unknown to the Committee, and it was distributed among the members of the Association under that name, but Carrière's name, *T. gigantea*, became generally current in English gardens. *T. Lobbii* was not distributed till three or four years later; and the late Mr. James Veitch, finding a *T. gigantea* already in cultivation, and desirous of paying a well-merited tribute to the exertions of Lobb, selected this beautiful *Thuya* to perpetuate his name" (Veitch, "A Manual of Conifers").

From Germany we learn that *Thuya gigantea* in some places does not thrive well. In the *Gartenflora* (1892, v. 122) Dr. G. Dieck, of Zöschchen by Merseburg, says in reference to it: "I can report that in this locality only a few well-sheltered single plants have survived the last winter (i.e. 1890-91). In my park it was necessary to cut down the two last strong specimens which under fear and pain had reached a diameter of about 15 cm."

To these remarks I may add that some plants of the *Thuya gigantea* in Denmark also suffered from the long and hard winter of 1890-91, but I do not think it was necessary anywhere to cut the plants down, and to the best of my knowledge all have recovered. On low ground young plants sometimes become red in spring-time, and some of them die. But in better localities, on light warm ground as well as in more loamy soil, we see fine old plants develop themselves into grander and grander beauty. Around Copenhagen fine old plants are to be seen. From a locality at Elsinore I am informed by the nurseryman Zeiner-Lassen that at his place the species does not succeed. In Jutland some trials were successful.

Thuya gigantea has in several Danish gardens attained a height of 40 feet and more. A specimen planted in 1864, and recently measured, was 36 feet in height, and 2 feet 6 inches in girth.

Thuya gigantea suffers sometimes from the cold at Stockholm.

T. g. aurescens, hort. *Thuya gigantea semper aurea*, hort.
Thuya Lobbii semper aurea, hort. *Thuya gigantea lutescens*, hort.
Thuya Lobbii lutescens, hort.

T. g. gracilis, hort. *Thuya gigantea gracillima*, hort. *Thuya Lobbii gracilis*, hort.

I think we cultivate in Denmark more varieties than I have here mentioned, but they have not yet been sufficiently observed to become determined.

T. occidentalis, L. Spec. Pl. 1422. *Arborvitæ*, Clus. Hist. i. 36. *Thuya Theophrastii*, Bauh. Pin. 488. *Thuya obtusa*, Moench. Meth. 691. *Cupressus Arborvitæ*, Targ. Tozz. Observ. Bot. ii. 51. *Cedrus Lycia*, Clus. Ic. ; Stirp. 11, t. 224.

Habitat.—New Brunswick to Anticosti Island, through the valley of the St. Lawrence River to the southern shores of James's Bay, and south-east to the eastern extremity of Lake Winnipeg, south through the Northern States to Central New York, Northern Pennsylvania, Central Michigan, Northern Illinois, Central Minnesota, and along the Alleghany Mountains to the high peaks of North Carolina.

A tree 40-60 feet in height, with a trunk sometimes 4-5 feet in diameter ; cold, wet swamps, and along the rocky banks of streams ; very common in the North, spreading over great areas of swamp ; extensively cultivated as a hedge and ornamental plant, and producing innumerable seminal varieties of more or less horticultural value.

Wood very light, soft, not strong, brittle, rather coarse-grained, compact, very durable in contact with the soil ; the bands of small summer cells very thin, dark-coloured ; medullary rays numerous, indistinct ; colour light brown, turning darker with exposure, the thin sapwood nearly white ; specific gravity, 0.3164 ; ash, 0.37 ; largely used for posts, fencing, railway ties, and shingles (Ch. S. Sargent, "Forest Trees of North America"). The distilled oil and a tincture of the leaves of *Thuya* have been found useful in the treatment of pulmonary and uterine complaints ("U.S. Dispensatory," ed. 14, 1775, and "Nat. Dispensatory," ed. 2, 1728).

The American *Arborvitæ* is much used in that country for its valuable properties in carpentry. It is very durable ; posts made of it are said to last from thirty-five to forty years, and rails sixty, which is considered three or four times as long as any other species. It is also frequently used in boat-building. The timber is of a reddish colour, very light, and close-grained ; but it seldom attains any considerable size in this climate, and is only suitable for the pleasure-ground or shrubbery, where it forms a handsome evergreen tree. Its branches are possessed of a strong aromatic smell. Kalm affirms that

the leaves, when bruised and mixed with hogs-lard, are efficacious for the removal of rheumatism.

In America the full-grown *Arborvitæ* is easily distinguished from all other trees by its shape and foliage. The trunk tapers rapidly from a very large base to a very slender summit, and is furnished with branches for four-fifths of its height. The principal limbs are widely distant from each other, placed at right angles with the trunk, and have a great number of drooping secondary branches. The bark upon the trunk is slightly furrowed, but smooth to the touch, and very white when the tree stands exposed. The wood is reddish, somewhat odorous, very light and soft, and very fine-grained. A cool soil seems to be indispensable to its growth. It is never seen on the uplands among the Beeches, the Birches, &c., but is found on the rocky edges of the innumerable rivulets and small lakes which are scattered over those countries; and it occupies in great part, or exclusively, swamps from fifty acres to a hundred acres in extent, some of which are accessible only in the winter, when they are frozen over and covered with several feet of snow. It abounds exactly in proportion to the degree of humidity which exists in the soil, and in the driest marshes it is mingled with the Black Spruce, the Hemlock Spruce, the Yellow Birch, the Black Ash, and a few specimens of the White Pine. In all of these marshes the surface is covered with a bed of *Sphagnum*, so thick and so surcharged with moisture that the foot sinks half-leg deep into it, while the water rises under the pressure. On the border of the lakes, where the *Arborvitæ* has room, and enjoys the benefit of the light and air, it rises perpendicularly, grows more rapidly, and attains a greater size than when crowded in the swamps, where its thick foliage intercepts the light from the trunk and impedes the circulation of the air. In the swamps its trunk is rarely straight, but forms an elliptic curve, more or less inclined to the ground (Michx.).

By a strange mistake of Linnæus, this species is handed down as a native of Siberia, because Gmelin (*Fl. Sib.* 182) mentions a *Thuya*, to which he misapplies the synonyms of the present, but which, by his own account, is different; for he says it is paler than the garden kind, and smaller in all its parts. It was brought to him by a travelling surgeon, from rocks near Pekin, in China, and could be no other than *Biota orientalis* (Smith in Rees's *Cyc.*). The American *Arborvitæ* appears to have been first introduced into Europe in the time of Francis I., at the beginning of the sixteenth century; Clusius having stated that the first tree that he saw of it was one in the Royal Garden at Fontainebleau, which had been sent from Canada as a present to that monarch.

From the shape of the main stem, Michaux observes, it is difficult to procure trunks of any considerable length with a uniform diameter; hence in the district of Maine the timber of this tree is little employed for the framework of houses, though in other respects it is

proper for this purpose. It is softer than the White Pine, and gives a weaker hold to nails, for which reason the Canadians always join it with more solid wood. The elder Michaux, in his journey to Hudson's Bay in 1792, found the church established there by the Jesuits yet standing. This building, constructed in 1728, as was proved by an inscription over the door, was built with square logs of the *Arborvitæ* laid one upon another, without covering on either side, and it had remained perfectly sound for more than sixty years.

Thuja occidentalis has in several gardens in different parts of Denmark attained a height of 50 feet and more. A plant of 32 feet in height, lately measured, was planted in 1845. Near Christiania this species has reached a height of about $47\frac{1}{2}$ feet. It does well at Upsala ($59^{\circ} 52'$). On the west coast of Finland it goes to 63° ; and it is even said to be found at Tornea ($65^{\circ} 51'$).

T. o. Spæthii, P. Smith. *Thuja occidentalis Ohlendorffi*, hort. *Thuja tetragona*, hort.

A most curious shaped variety, with two forms of branches.

T. o. theodonensis, hort. *Thuja occidentalis magnifica*, hort.

A free-growing variety, darkish green, of pyramidal growth, and with broad and thick branches.

T. o. Wareana, Hort. *Thuja occidentalis robusta*, Carr. Conif. ed. 2, 109. *Thuja Wareana*, hort. *Thuja sibirica*, hort. *Thuja caucasica*, hort. *Thuja* (?) *occidentalis densa*, Gord. Pinet. suppl. 103.

One of the commonest varieties, and one of the best.

T. o. Wareana lutescens, Hesse.

Raised by Mr. Hesse, nurseryman at Weener, in N.W. Germany.

T. plicata, Don, Hort. Cantabr. ed. 6, 249. *Thuja odorata*, Marsh. Arb. America, 243. *Thuja Wareana*, Booth, Catal. 1839. *Thuja occidentalis compacta*, Knight in Gord. Pinet. *Thuja sibirica*, hort. aliq. *Thuja caucasica*, hort. aliq. *Thuja asplenifolia*, hort. *Thuja lycopodioides*, hort. *Thuja flabellata*, hort. *Thuja plicatilis*, hort. *Thuja occidentalis plicata*, Loud.

Habitat.—North-west America, near Nutka Sound. It attains in America a height of 49–65 feet.

Introduced in 1796.

Thuja plicata has in some Danish gardens grown to a height of 40 feet and more.

T. Standishii, Carr. Conif. suppl. 108. *Thuja japonica*, Maxim. in Diagn. Plant. Jap. dec. i. 1866, p. 26; Mém. Biol. St. Petersb. t. vi. (not *Thuja japonica* of English gardens). *Thuja gigantea* var. *japonica*, Franch. et Savat. Enum. Pl. Jap. i. 469. *Thuyopsis Standishii*, Gord. suppl. 100.

Habitat.—Central Mountains in Japan.

Introduced by Fortune, 1861.

It grows well in several Danish gardens. Here and there it has produced cones.

6. THUYOPSIS.—Sieb. and Zucc. Fl. Jap. ii. 32; Endl. Conif. 53; Carr. Conif. ed. 2, 117; Gord. Pinet. 319; Henkel and Hockstetter, Nadelh. 287. *Thuya* species, Linn. suppl. 420; Thunb. Fl. Jap. 266. *Platycladi* species, Spach, Hist. des Vég. Phanér. xi. 333; Parl. in D. C. Prodr. xvi. 2, 460; Gord. Pinet. 319; Koch, Dendr. ii. 185; Eichler in Engl. and Prantl. Natürl. Pfl. ii. p. 95; Beissn. Handb. d. Nadelhölzk. 1891, 51.

Flowers monœcious, solitary, and terminal; the male catkins cylindrical, the female somewhat globular.

Cones ligneous, sub-globular, and composed of eight or ten valvated, opposite, imbricated scales.

Scales wedge-shaped, leathery, valvate, more or less orbicular, concave, smooth, and persistent.

Seeds five at the base of each scale, orbicular, compressed, and free, with a membranaceous wing on each side.

Leaves scale-like, opposite decussate pairs, regularly and closely imbricated in four rows, flattened on the upper and under surfaces.

Name derived from *Thuya*, the Arborvitæ, and *opsis*, like—resembling the Arborvitæ.

Only one majestic evergreen tree, found in moist situations in Japan, now belongs to this genus; formerly the *Chamæcyparis nuthkaensis* was often, and is still sometimes, called *Thuyopsis borealis*.

T. dolabrata, Sieb. and Zucc. Fl. Jap. ii. 34, t. 119, 120. *Thuya dolabrata*, L. suppl. 420; Thunb. Fl. Jap. 206. *Platycladus dolabrata*, Spach, Hist. Vég. Phan. xi. 337.

Habitat.—Japan, between 30° and 38° N., on high mountains.

Thuyopsis dolabrata was first made known to Europeans by Thunberg, in 1784. The first living plant received in England was sent to Messrs. Veitch's Exeter nursery by Mr. Thomas Lobb, in 1853, from the Botanic Garden at Buitenzorg, in Java. This plant arrived in a weak condition, and all efforts to save it proved fruitless. In 1855 a plant was received at the Botanic Garden at Leyden from Dr. Siebold (*Gardeners' Chronicle*, 1855, p. 241); but it was not till 1861, when Mr. J. G. Veitch, and later in the same year Mr. Robert Fortune, sent plants and seeds to the Chelsea and Ascot nurseries respectively, that this fine Conifer became generally distributed (Veitch, *Manual of Conif.*).

Thuyopsis dolabrata, planted in 1879, has attained a height of 11 feet. Plants with top-shoot are not so rare here as in many parts of Germany.

T. d. nana, Sieb. and Zucc. Flor. Jap. ii. 34. *Thuyopsis latevirens*, Lindl. *Gardeners' Chronicle*, 1861, p. 428.

The commonest name for this variety seems still in nurseries to be *Thuyopsis dolabrata latevirens*.

Introduced by Mr. J. G. Veitch in 1861.

T. d. variegata, hort.

Introduced by Mr. Fortune in 1861.

7. **BIOTA**.—Endl. Conif. 46 ; Carr. Conif. ed. 2, 92 ; Gord. Pinet. 32. *Thuya* sp. Linn. Gen. n. 1079. *Platycladus*, Spach, Hist. des Vég. Phan. xi. 333 (except sp.). Lamb. Pinet. t. 76 ; L. C. Rich. Conif. t. 7, f. 2 ; Forbes, Pinet. Wob. t. 63 ; Bot. Reg. 1842, t. 20 ; Nees, Gen. Fl. Germ. Monochl. xi. ; Sieb. and Zucc. Fl. Jap. t. 117, 118 ; Parl. in D. C. Prodr. xvi. 2, 461 ; Koch, Dendr. ii. 180 ; Eichler in Engl. and Prantl. Natürl. Pflf. ii. 98 ; Beissn. Nadelh. 54.

Flowers monœcious ; male catkins oval or conical, female ones solitary and globular.

Cones roundish, squarrose, and composed of from six to eight leathery valves or scales.

Scales in opposite decussate pairs, peltate, and furnished with a spiny point just below the apex, and each containing two seeds at the base.

Seeds in twos under each scale, ventricose, crustaceous, and wingless, or only furnished with rudimentary ones.

Cotyledons two.

Leaves scale-like, very small, in opposite decussate pairs, adpressed or imbricated in four rows.

Name derived from *bi*, two, and *otis*, an ear.

B. orientalis, Endl. Conif. 47. *Thuya orientalis*, L. Spec. Pl. 1422. *Thuya acuta*, Moench. Meth. 692. *Cupressus Thuya*, Targ. Tozz. Observ. ii. 52. *Platycladus stricta*, Spach, Hist. Vég. Phan. xi. 335. *Finoki altera*, *Cupressus vulgaris*, &c., Kæmpf. Amœn. Exot. 884.

The Biota is a native of China and Japan, especially in Nippon and Sikok, where it has also been long cultivated as an ornamental shrub, and where many interesting varieties have been raised, some of which have been introduced into British gardens. The common form was first brought to Europe about the middle of the eighteenth century by French missionaries ; it has been in cultivation in England since 1752. Very likely this species extends further west and south in Central Asia than even China.

It seems as if varieties with cylindrical or cone-like forms are more hardy than those of globular form. Of the latter I have seen splendid plants close to the Rhine in Germany.

Biota orientalis seems in Denmark to thrive best on somewhat loamy, and even grows well on cold, ground, where it has attained 20 feet in height and more. In the villa quarters near Copenhagen several such plants are to be seen, and they look quite hardy. The more globular-formed varieties are not seen in such aged specimens, and perhaps they would not grow here so luxuriantly. One plant, lately measured, planted in 1864, is 16 feet in height ; another of the same age has only reached a height of 10 feet 6 inches.

Professor Schübeler says in his "Viridarium Norvegicum," p. 372, that the Biota does well at Christiania, and here and there along the coast ; but he has not seen it farther north than at Molde (62° 44'). In Sweden it thrives well in the southern and south-western parts

of the country, but at Stockholm and Upsala it cannot be called hardy.

B. o. aurea erecta, hort. *Biota orientalis aurea nana*, hort. *Thuya aurea*, hort. *Thuya nana aurea*, hort. *Thuya nana compacta aurea*, hort.

This valuable variety originated in the nursery of Mr. Anthony Waterer, at Knap Hill, Woking.

B. o. decussata, Beissn. and Hockst. *Retinospora juniperoides*, Carr. Conif. ed. 2, s. 140. *Retinospora rigida*, Carr. Mss. *Retinospora squarrosa*, hort. *Retinospora flavesens*, hort. *Chamæcyparis decussata*, hort. *Juniperus glauca*, hort. *Frenela glauca*, hort.

This variety originated in the nursery of Messrs. Rollisson, at Tooting.

B. o. flagelliformis, Jacq. Monogr. Conif. 25. *Cupressus pendula*, Thunb. Fl. Jap. 265. *Cupressus patula*, Pers. Syn. ii. 580. *Cupressus pendulata*, hort. *Cupressus filiformis*, hort.

This curious variety, long believed to be a distinct species, is now known to have originated from the common form. It was met with in cultivation in China and Japan many years ago, and forms perfectly identical were subsequently raised from seed both in England and France. During a visit to the Botanic Garden at Turin in the autumn of 1860 Dr. Hooker had his attention drawn to a fine specimen of *Biota pendula*, bearing fruit in all respects like that of *B. orientalis*. On inquiry it was proved to him that plants of *B. orientalis* which were pointed out by the curator of the garden had been raised from seeds of *B. pendula*, thus showing beyond all doubt that *B. orientalis* and *B. pendula* are only forms of one species (*Gardeners' Chronicle*, 1861, p. 575).

B. o. filiformis stricta, hort. *Biota orientalis filiformis erecta*, hort. *Biota orientalis filiformis compacta*, hort. *Thuya* or *Biota japonica*, in Belgian gardens. *Thuya filiformis japonica*, hort.

B. o. semperæurescens, hort. *Biota orientalis semperæurea*, hort. *Biota semperæurescens* or *semperæurea*, hort. *Thuya semperæurescens* or *semperæurea*, hort.

It originated in the nursery of M. Lemoine, Nancy, France.

8. CHAMÆCYPARIS.—Spach, Hist. Nat. des Vég. Phan. xi. 329; Endl. Conif. 60; Carr. Conif. 132; Gord. Pin. 48. *Cupressi* sp. Linn. Sp. Pl. 1422. *Thuya* sp. Rich. Conif. 45 and *aliq.* *Chamæpeuce*, Zucc. in Endl. Enchir. Bot. 139. *Retinispora*, Sieb. and Zucc. Fl. Jap. ii. 36; Gord. Pin. 294; Traut. Imag. Pl. Ross. t. 7; Bot. Mag. t. 5581; Mich. N. Am. Sylv. t. 152; Parl. in D. C. Prodr. xvi. 2, 463; Maxim. in Bull. Acad. Sc. Petersb. x. 489; Mél. Biol. vi. 25; Eichler in Engl. and Prantl. Natürl. Pflf. ii. p. 100; Willk. Forst. Flora, p. 247; Hall in Coulter's Bot. Gazette,

ii. 91 ; G. M. Dawson in Canadian Nat. ser. 2, ix. 329 ; Hoopes, Evergreens, 346 ; Vasey, Cat. Forest Trees, 36 ; Veitch, Manual Conif. 238 ; Carr. Tr. Gén. Conif. ed. 2, 120 and 791 ; Beissn. Nadelh. 1891, 64.

Flowers monoecious, terminal ; male catkins cylindrical, female ones globular.

Cones ligneous, very small, globular or oblong, numerous, and covered with a glaucous bloom.

Scales mostly seven or eight in number, oblong or rounded, shield-shaped, and in decussate opposite pairs.

Seeds convex, a little flattened on one side, hard-shelled, in sunken grooves, two at the base of each scale, and either wingless or very slightly furnished with rudimentary ones.

Leaves scale-formed, in opposite pairs, four-rowed, with a sunken groove or gland on the back, glaucous and persistent.

Cotyledons two.

Name derived from *chamæ*, ground, and *cyparis*, the Cypress—the ground or swamp Cypress.

Evergreen trees and shrubs, found in North America, in the south-east and the north-west, and in Japan, from whence most beautiful hardy species and varieties have been introduced.

The generic name *Retinispora* (often falsely written *Retinospora*) was chosen by Siebold and Zuccarini for the Japanese species *Ch. obtusa* and *Ch. pisifera*, but as there is so little difference this generic name has been almost abandoned on the Continent, where now the above name is predominant.

C. Lawsoniana,* Parl. Stud. sui Fiori e Frutti delle Conif. xxiii. 29, t. 3, f. 22-25. *Cupressus fragrans*, Kellogg in Proc. California Acad. i. 103. *Chamæcyparis Boursierii*, Carr. Conif. 125 (not Decaisne). (?) *Cupressus attenuata*, Gord. Pinet. ed. 1, 57, ed. 2, 79. *Cupressus Lawsoniana*, Murr. Descrip. of the New Conif. Trees fr. Calif. xi. t. 9. *Cupressus nutkanus*, Torrey, Bot. Wilkes' Exped. t. 16.

Habitat.—Oregon, Coos Bay, south to the valley of Rogue River, not extending more than thirty miles from the coast. California, valley of the Upper Sacramento River (shores of Castle and Soda Lakes, Shasta County).

A large tree of the first economic value, 150-200 feet in height, with a trunk 6-13 feet in diameter ; rich woods, in low, moist soil, interspersed with the Yellow Fir and Hemlock Spruce ; most common, and reaching its greatest development, along the Oregon coast ; local ; in California very rare and local.

Wood light, hard, strong, very close-grained, compact, easily worked, very durable in contact with the ground, abounding in

* Better known in England as *Cupressus Lawsoniana*.

odoriferous resin, satiny, susceptible of a beautiful polish ; layers of small summer cells thin, not conspicuous ; medullary rays numerous, very obscure ; colour light yellow or almost white, the thin sapwood hardly distinguishable ; specific gravity, 0.4621 ; ash, 0.10 ; largely manufactured into lumber and used for interior finish, flooring, railway lines, fence posts, matches, and in ship and boat building ; the resin strongly diuretic and a powerful insecticide (Ch. S. Sargent).

It was named in compliment to Mr. Charles Lawson, of Edinburgh, head of the well-known horticultural firm of Peter Lawson & Sons, and, at one time, Lord Provost of the city.

Chamæcyparis Lawsoniana is in different Danish parks and forests to be seen of a height of more than 40 feet. One plant, just now measured, and planted in 1864, has attained a height of 32 feet and a girth of 8 feet 10 inches.

Young plants sometimes suffer on somewhat low ground, but they are rarely killed. Most beautiful specimens are to be seen in many gardens and forests. In some Danish nurseries seeds from California have been sown, and the result has been that some plants of light colour and less pyramidal growth have not proved so hardy as the more pyramidal seedlings with a more glaucous hue.

About the Lawson Cypress Prof. Schübeler reports in his "Viridarium," p. 374, that it looks finer than the *Chamæcyparis nutkaensis*, but it is perhaps not so hardy. It is to be found in different places in the South of Norway, but so far as he knows it is not tried farther north than Molde (62° 44'), where it thrives very well. At Horten (59° 25') is to be found a specimen which in September 1871 measured 5.6 mètres in height. At Christiansund (58° 8') Prof. Schübeler has seen the varieties *pyramidalis* and *erecta viridis*. At Christiania (59° 55') this species keeps well, but still, he says, it seems not so hardy as *C. nutkaensis*.

In the southern parts of Sweden it thrives well as far as Upsala. At Stockholm there was planted out in 1867 a specimen only a few inches high. This plant had in 1884 reached a height of 15 Swedish feet, and had for several years produced ripe seeds.

Writing of the Lawson Cypress, Dr. Dieck, of Züschen, near Merseburg, says, in the *Gartenflora*, 1892, Heft v. 122 : "I and some other writers regard it as the tree of the future for the lowland parts of Middle Germany, especially for cemeteries, as, from its sombre appearance, it is very suitable for planting in the 'gardens of the dead.' As is well known, but few specimens of the Oregon Cedar were sufficiently hardy to survive the severe winter of 1890-91 ; while in many localities—even in Holland—not a single plant could be found that was uninjured by the frost."

C. L. alba variegata. Originated in Veitch's Coombe Wood Nursery.

C. L. Alumi, hort. A most beautiful pyramidal and bluish variety.

C. L. argentea, hort. Originated in the nursery of Mr. Anthony Waterer, Knap Hill.

C. L. argentea variegata. Originated in the nursery of Messrs. Lawson, Edinburgh.

C. L. erecta viridis, hort. *Cupressus erecta viridis*, hort. Originated in the nursery of Mr. Anthony Waterer.

C. L. gracilis pendula, hort. Originated in the nursery of Messrs. Barron & Son, Borrowash, near Derby.

C. nutkaensis, Spach, Hist. Vég. Phan. xi. 333. *Thuya excelsa*, Bong. Végét. de l'Île de Sitcha, 46. *Cupressus nutkaensis*, Lamb. Pinet. ed. 2, 113, n. 48. *Cupressus nutkaensis*, Hook. Fl. Bor. Amer. ii. 165. *Cupressus americana*, Traut. Imag. Plant. Fl. Ross. xii. t. 7. *Callitropsis nutkaensis*, A. S. Oersted, Frilands-Trövösten (Denmark, 1864), 17. *Chamæcyparis excelsa*, Fisch. Herb. *Thuyopsis borealis*, hort. *Thuyopsis Tchugatskoyæ*, hort.

Habitat.—Nootka Sound, Sitka, Vancouver, south along the islands and coast ranges of British Columbia, and the Cascade Mountains between 44° and 55° N.; Washington Territory and Oregon to the valley of the Santian River, Oregon ("Lucky Camp Mountain," Cusick).

A large tree of great economic value, 100–125 feet in height, with a trunk 4–6 feet in diameter, or toward its southern limits and at high elevations much smaller; common along the coast at the sea-level to about latitude 49° 30' N., then less common and only at higher elevations; south of British Columbia hardly below 5,000 feet elevation, and very rare and local. The most valuable timber tree of Alaska.

Wood light, hard, not strong, brittle, very close-grained, compact, very durable in contact with the soil, easily worked, satiny, susceptible of a beautiful polish, possessing an agreeable resinous odour; bands of small summer cells thin, not conspicuous; medullary rays thin, numerous, hardly distinguishable; colour bright, light clear yellow, the thin sapwood nearly white; specific gravity, 0·4782; ash, 0·34; somewhat used in boat and ship building, for furniture, interior finish, &c.; probably unsurpassed in beauty as a cabinet wood by that of any North American tree (Ch. S. Sargent).

Mr. Menzies was the first discoverer of this species. He obtained specimens from Nootka Sound, when Vancouver (with whom he sailed as surgeon and naturalist) stopped there in his celebrated voyage round the world; and from his specimens Lambert described it in his "Genus Pinus." It was introduced from the Botanic Garden of St. Petersburg into Europe, under the name of *Thuyopsis borealis*, about 1850, and is now plentifully distributed.

Mr. R. Brown, who collected for the Edinburgh "British Columbia Botanical Association," in one of his letters incidentally notices one or

two of the purposes to which it is put. He says: "Next morning, looking about our neighbourhood, we re-entered our canoe, hollowed out of *Cupressus nutkaensis*, the mats we sat upon being made of the fibre of the same tree, ropes of the same material, and occasionally of *Thuja plicata*."

Chamæcyparis nutkaensis is perhaps not to be seen in Danish gardens much older than 30 years, and of some 20 feet in height. One plant, just now measured, has attained a height of $27\frac{1}{2}$ feet and a girth of 1 foot 6 inches. It was planted in 1870. This species thrives at Christiania, and even at Upsala ($59^{\circ} 52'$).

C. obtusa, Sieb. and Zuccar. in Endl. Conif. 63. *Retinispora obtusa*, Sieb. and Zucc. Fl. Jap. ii. 38, t. 121. *Cupressus obtusa*, C. Koch, Dendr. ii. 168. *Thuja obtusa*, Benth. and Hook. *Chamæcyparis acuta*, hort.

Habitat.—Japan, from 30° to 38° N., and at 1,300–3,250 feet elevation, but also in valleys.

Introduced in 1861 by John Gould Veitch.

C. pisifera, Sieb. and Zucc. in Endl. Conif. 64. *Retinospora pisifera*, Sieb. and Zucc. Fl. Jap. ii. 39, t. 122. *Cupressus pisifera*, C. Koch, Dendr. ii. 170. *Thuja pisifera*, Benth. and Hook.

Habitat.—Japan, between 30° and 38° N. Grows together with *Chamæcyparis obtusa*, but it grows on lower and more moist ground, and also goes higher up the mountains.

Introduced into Europe in 1861.

Very large plants of *Chamæcyparis pisifera* are not to be found yet in Danish gardens; still a specimen, planted in 1879, has attained a height of 12 feet.

C. p. plumosa, hort. *Chamæcyparis plumosa*, hort. *Retinospora plumosa*, Veitch.

This variety is in some Danish gardens to be found with a height of 12 feet; one plant thus measured was planted in 1879.

C. sphæroidea, Spach, Hist. Vég. Phan. xi. 331. *Cupressus nana Mariana*, &c., Pluk. Mant. 61, t. 345. *Cupressus thyoides*, L. Spec. Pl. 1422. *Thuja sphæroidalis*, Rich. Conif. 45, t. 8.

Habitat.—Southern Maine; south, near the coast, to Northern Florida, and along the Gulf coast to the valley of the Pearl River, Mississippi. Not in Canada.

Introduced into Europe in 1736 by Peter Collinson.

A tree 80–90 feet in height, with a trunk 2–4 feet in diameter, in deep, cold swamps; rare in the Gulf States west of the Bay of Mobile.

Wood very light and soft, not strong, close-grained, compact, easily worked, very durable in contact with the soil; bands of small summer cells thin, dark-coloured, conspicuous; medullary rays numerous, obscure; colour light brown tinged with red, growing darker with

exposure, the sapwood lighter; specific gravity, 0.3322; ash, 0.35; largely used in boat-building, for wooden-ware, cooperage, shingles, interior finish, telegraph and fence posts, railway ties, &c. (Ch. S. Sargent, "Forest Trees of North America"). Along the Atlantic coast, from New Jersey southward, lumber is manufactured from buried trunks of this species dug from peat swamps.

The wood, on account of its lightness and its power of resisting alternations of dryness and moisture, is in common use at Baltimore and Philadelphia for shingles, which are cut transversely to the concentric circles, and not parallel to them like shingles of the deciduous Cypress, *Taxodium distichum*. They are from 2 feet to 2 feet 3 inches long, from 4 inches to 6 inches broad, and three lines thick at the larger end. At Baltimore they are commonly called Juniper shingles, and are there preferred to those of the deciduous Cypress, as they are larger and free from the defect of splitting when nailed upon the rafters. Some of the houses of Philadelphia, Baltimore, and New York have been covered with them, and large quantities are exported to the West Indies. The shingles of the White Cedar are much more durable and secure from worms than those of the White Pine, generally lasting from 30 to 35 years. The wood is also considered well adapted for joinery and for household utensils. In Philadelphia there is a distinct class of mechanics called Cedar coopers, who make pails, wash-tubs, churns, &c., of the wood of this tree for both the home and the foreign markets. These utensils are held together with hoops made of young Cedars stripped of their bark, and split down the middle. In some places the sides of fishing-boats are covered with White Cedar clap-boards, which are preferred to those of the deciduous Cypress, as being lighter, more durable, and less liable to split. The wood makes excellent sounding-boards for pianofortes; and casks formed of it are found better than any others for preserving oils. The young wood makes an excellent charcoal for gunpowder; and the smoke of the seasoned wood affords a beautiful lampblack, which weighs less and is more intensely coloured than that obtained from any species of Pine. When employed as fence-wood, the rails of young trees, either entire or split down the middle, and deprived of their bark, last from 50 to 60 years (J. C. Loudon, "Arboretum et Fruticetum Britannicum," ed. 2, iv. 2476).

Chamaecyparis sphaeroidea, of about 100 years of age, have in some Danish gardens grown to a height of nearly 50 feet. A tree, lately measured, planted in 1845, has attained a height of 26 feet.

C. s. andelyensis, Carr. Conif. ed. 2, 123. *Chamaecyparis leptoclada*, Hochst. *Retinospora leptoclada*, Hort.

This shrub, which is often cultivated in England under the name of *Retinospora leptoclada*, originated many years ago in the nursery of M. Canchois, at Andelys, in France. It appeared among a batch of seedlings of *C. sphaeroidea*, and the proprietor, finding it of very

different habit and aspect from the others, propagated it by cuttings, and subsequently exhibited young plants of it at Paris under the name of *Chamaecyparis spherioidea andelyensis*. The stock passed into the hands of Messrs. E. G. Henderson & Son, of London, by whom it was introduced to British gardens under the wrong name it still often bears there (Veitch, Man. of Conif. 244).

9. CUPRESSUS.—Tourn. Inst. 358 ; Linn. Gen. Pl. n. 1079 ; Juss. Gen. 413 ; Rich. Conif. 142, t. 9 ; Endl. Conif. 142, t. 9 ; Endl. Gen. 259, n. 1791, and Conif. 55 ; Spach, Hist. Nat. des Vég. Phan. xi. 323 ; Carr. Conif. 114, and ed. 2, 143 ; Gord. Pin. 56 ; Henkel and Hochstetter, Syn. der Nadelh. 230 ; Parl. Fl. Ital. iv. 70. *Juniperi* sp. Bonpl. Pl. Exsic. Cat. *Chamaecyparis* sp. Endl. Conif. 62 ; Parl. in D. C. Prodr. xvi. 2, 467 ; Lamb. Pin. t. 42, ed. min. t. 65 ; Forbes, Pin. Wob. t. 61 and 62 ; L'Her. Stirp. Nov. t. 8 ; Wats. Dendrol. Brit. t. 155 ; Eichler in Engl. and Prantl. Natürl. Pflf. ii. p. 99 ; Willk. Forst. Flora, p. 245 ; Lawson, Pinet. Brit. ii. 195, t. 32 ; Beissn. Nadelh. 99.

Flowers monœcious ; male catkins cylindrical and numerous, female ones roundish, and either in clusters or solitary.

Cones somewhat globular, and composed of angular, irregularly shaped, four to six pointed woody scales, externally shield-shaped.

Scales from six to ten in number, irregularly four- or five-sided, raised in the centre, and terminating in a more or less curved point.

Seeds numerous, inserted on the upper interior surface of the scales, angularly compressed or ovate, with a bony covering, extending into a membranaceous wing at the margins.

Cotyledons in twos or threes, rarely in fours, but mostly in twos.

In the true *Cupressus* the leaves along the branchlets are mere scales, closely imbricated, or tiled over each other, and generally in four rows, with the branches always scattered along the stem, and the buds not scaly. Cones more or less rounded, and composed of from six to ten peltate woody scales, furnished with a projecting point or boss in the centre, which scales, when the seeds are ripe, become dry and separate. All the species exude resin, but afford no turpentine.

The name *Cupressus*, according to some writers, is derived from the first species having been found plentifully on the Isle of Cyprus ; but as the Cypress appears to have been known to the ancient Hebrews, Greeks, and Phœnicians, it is much more probable that the converse is the true statement, and that the island was named from the tree being found plentifully upon it. According to other writers the name is derived from "*Cyparissus*," a beautiful youth of the Island of Ceos, who, according to tradition, was changed into a Cypress.

All large bushes or trees, found in the South of Europe, China,

California, Mexico, Guatemala, United States of North America, and the East Indies.

Most of them are not hardy in the northern part of Europe, where they are cultivated in conservatories.

C. Cashmeriana, Royle. *Cupressus torulosa*, Gord. Pin. 69 ; Carr. Tr. Gén. Conif. ed. 2, 161.

Habitat.—Thibet.

Introduced about 1862.

Wintered indoors in Denmark.

C. funebris, Endlicher. *Cupressus pendula*, Staunt. Embass. China, ii. 415, t. 41 ; Lamb. Pin. ed. 2, ii. 111, t. 50 ; Loud. Arbor. iv. 2479, f. 2332-3 (excl. syn. omn.), and Encycl. of Trees, 1077, 2003-4 (excl. syn. Thunb.). *Cupressus funebris*, Endl. Syn. Conif. 58 ; Lindl. and Gord. Journ. Hort. Soc. v. 206 ; Fl. des Serres, vi. 89 (*cum ic.*) ; Paxt. Flow. Gard. i. 46, f. 31 ; Knight, Syn. Conif. 19 (excl. syn. Thunb.) ; Carr. Man. des Pl. iv. 325 ; Tr. Gén. Conif. 120, and ed. 2, 161 ; Gord. Pin. 59 ; Henk. and Hochst. Syn. der Nadelh. 236 ; J. E. Nelson, Pinac. 71.

Habitat.—China, where it is often planted in cemeteries.

Introduced into Europe by Fortune in 1848.

Wintered indoors in Denmark.

C. Goveniana, Gordon. *Cupressus* sp. Hartw. ex Knight, Syn. Conif. 20. *Cupressus Goveniana*, Gord. Journ. Hort. Soc. iv. 295 ; Lindl. and Gord. l.c. v. 206 ; Knight, l.c. ; Carr. Man. des Pl. iv. 326, Tr. Gén. Conif. 125, and ed. 2, 170 ; Gord. Pin. 60 ; Henk. and Hochst. Syn. der Nadelh. 240. *Cupressus glandulosa*, hort.

Habitat.—Discovered by Hartweg in California, near Monterey, Humboldt County. South, along the coast, and through the coast ranges into Lower California.

Introduced in 1847.

Wintered indoors in Denmark.

A small tree, sometimes 40-50 feet in height, with a trunk 2-3 feet in diameter ; borders of streams and mountain slopes, in rather rich soil, or often a low shrub, fruiting when 1-3 feet in height, and occupying extensive tracts of sandy barrens one to five miles inland from the coast, or thin, rocky soil (Pringle) ; widely but not generally distributed.

Wood light, soft, not strong, brittle, close-grained, compact ; bands of small summer cells broad, dark-coloured, conspicuous ; medullary rays thin, obscure ; colour light brown, the thick sapwood nearly white ; specific gravity, 0.4689 ; ash, 0.45 (Ch. S. Sargent).

C. guadalupensis, Watson, Proc. Am. Acad. xiv. 300 ; Bot. California, ii. 114. *Cupressus macrocarpa* (?), Watson in Proc. Am. Acad. xi. 119 (not Hartweg). *Cupressus arizonica*, E. L. Greene in

Bull. Torr. Bot. Club, ix. 164; Rusby in Bull. Torr. Bot. Club, ix. 79; Watson in Proc. Am. Acad. xviii. 157.

Habitat.—San Francisco, mountains of New Mexico and Eastern Arizona (Greene, Rusby), Santa Catalina and Santa Rita mountains, Arizona (Pringle, Lemmon); on the Sierra Madre, near Saltillo, and on Guadalupe Island, Mexico (Palmer).

A tree 60–70 feet in height, with a trunk 2–3 feet in diameter; rocky cañons and ridges on the New Mexico and Arizona mountains, forming extensive forests between 5,000 and 8,000 feet elevation, generally on northern slopes; local.

Wood light, soft, very close-grained, compact, easily worked, susceptible of a good polish; bands of small summer cells broad, conspicuous; medullary rays numerous, very obscure; colour grey, often faintly streaked with yellow, the thick sapwood light yellow; specific gravity, 0.4843; ash, 0.44 (Ch. S. Sargent).

Wintered out of doors, only covered with a few Spruce branches. It seems to be almost hardy in Denmark.

C. Knightiana, hort. *Cupressus elegans*, hort. *Cupressus thurifera elegans*, hort. ex Gord. Pin. 61. *Cupressus thurifera Knightiana*, Gord. l.c. *Cupressus Knightiana*, hort. Knight, Syn. Conif. 20; Carr. Man. des Pl. iv. 326, Tr. Gén. des Conif. 127, and ed. 2, 158, 159; Gord. Pinetum (excl. syn. *Lindleyi* and *Coulteri*); Henk. and Hochst. Synop. der Nadelhölz. 239; J. E. Nelson, Pinac. 72.

Habitat.—Mexican mountains.

Introduced into Europe in 1840.

Wintered indoors.

C. lusitanica, Miller. *Juniperus* ex Goa, Herm. Hort. Batav. 346. *Juniperus glauca*, hort. Cels. Willd.; Hort. Berol. Enumer. Suppl. 67; Link, Enumer. Alt. ii. 435. *Cupressus lusitanica patula*, fructu minore, Tournef. Inst. 587; Duham. Arbr. i. 198. *Cupressus glauca*, Broter. Fl. Lusit. i. 216; Lamb. Dict. ii. 243; Endl. Syn. Conif. 58; Lindl. and Gord. Journ. Hort. Soc. v. 206; Spach, Hist. Vég. Phan. xi. 328. *Cupressus pendula*, Herit. Stirp. 15, t. 18; Desf. Hist. Arbr. ii. 536 (not Thunb. nor Lamb. nor Staunt.). *Cupressus thurifera*, Schlect. in Linnæa, xii. 93; Benth. Plant. Hartweg, No. 434; Knight, Syn. Conif. 19; Humb. Bonpl. and Kunth, Nov. Gen. et Spec. ii. 3. *Cupressus sinensis pendula*, hort. *Cupressus Udeana*, Hort. (not Gord.). *Cupressus glauca pendula*, hort. *Cupressus sinensis*, Lee ex Gord. Pin. 63. *Cupressus sinensis pendula*, hort. ex Gord. l.c. *Cupressus sinensis glauca*, hort. ex Gord. l.c. *Cupressus Libani glauca*, Knight ex Gord. l.c. *Cupressus lusitanica elegans*, Gord. Pin. suppl. 25 (excl. syn. *tristis*). *Cupressus goensis*, hort. *Cupressus glauca pendula*, hort. *Cupressus lusitanica*, Mill. Dict. n. 3; Willd. Spec. iv. 511; Loisel. Nouv. Duham. iii.

t. 3; Lamb. Pin. ed. 2, ii. 109, t. 65; Loud. Arbor. iv. 2477, f. 2328, and Encycl. of Trees, 1075, f. 1998; Forb. Pin. Wob. 177, t. 60; Knight, Syn. Conif. 19; Carr. Man. des Pl. iv. 325, Tr. Gén. Conif. 119, and ed. 2, 153; Gord. Pin. 63, and Suppl. 25.

Habitat.—Indian peninsula, especially in Goa.

Introduced two hundred years ago.

Wintered indoors.

C. MacNabiana, Murray, Descrip. of Conif. Trees from Calif. 12, t. 10. *Cupressus glandulosa*, Hook. ex Gord. Pin. 64. *Juniperus MacNabiana*, Laws. Catal. ex Gord. l.c. *Cupressus MacNabiana*, A. Murr. Ann. Soc. Bot. Edinb. 1855; Gord. Pin. 64; Henk. and Hochst. Syn. der Nadelh. 241; Carr. Tr. Gén. Conif. ed. 2, 165; Beissn. Nadelh. 100.

Habitat.—Different mountains of Northern California, south of Clear Lake, at 41° S. latitude, and at about 5,000 feet in height. Lake County.

Introduced into Europe in 1856.

A small tree, sometimes 30 feet in height, with a trunk 1-1½ foot in diameter, or more often a tall shrub branching from the ground; very rare and local; not rediscovered in the original station reported by Jeffrey, the Mount Shasta region (Ch. S. Sargent, "Forest Trees of North America").

Wintered indoors.

C. macrocarpa, Hartweg in Journ. Hort. Soc. ii. 187. *Cupressus Lambertiana*, Carr. Conif. 124. *Cupressus Hartwegii*, Carr. Conif. 168; Carr. in Rev. Hort. 1855, 232. *Cupressus Reinwardtii*, hort.

Habitat.—California, Monterey (Cypress Point, Pescadero Ranch, and Carmelo Point).

A tree 50-70 feet in height, with a trunk 4-6 feet in diameter; on granite rocks immediately upon the sea-coast; very local (Ch. S. Sargent).

According to Gordon, seeds of a Cypress were given to the Royal Horticultural Society in 1838, by Mr. Lambert, without name or other information. These seeds were raised, and the seedlings proving different from any other Cypress known, the plant received the garden name of *C. Lambertiana*, a name which does not appear to have been formally published. Gordon further says that on subsequently visiting Mr. Low's nursery at Clapton he observed a plant of the same kind which had been received from California, through His Excellency Professor Fischer of St. Petersburg. In 1846, Hartweg, writing an account of his mission to California in search of plants for the Horticultural Society, mentions finding his No. 143, *Cupressus macrocarpa*, at Carmel Bay. The tree is described by him as "attaining the height of 60 feet, with a stem 9 feet in circumference, with far-spreading branches, flat at the top like a

full-grown Cedar of Lebanon, which it closely resembles when seen at a distance" ("Pinetum Britannicum").

Three plants were put out of doors for trial in Denmark. In the long and hard winter of 1890-91 all the plants suffered, although covered either with a mat of straw or with spruce branches; two plants died, the one left is now growing well.

C. sempervirens, L. Sp. Pl. 1422; Rich. Conif. t. 9.

Habitat.—Western Asia, Syria, Persia, the Himalayas, and in Southern Europe.

Introduced into Northern and Western Europe about 1550.

C. s. fastigiata, D. C. Fl. Franc. v. 336. *Cupressus femina*, Cæsalp. de Plant. lib. iii. cap. 55, p. 134. *Cupressus sempervirens*, L. l.c. *Cupressus sempervirens pyramidalis*, hort. *Cupressus pyramidalis*, Targ. Tozz. Obs. Bot. dec. 3-5, p. 53. *Cupressus conoidea*, Spad. Xilogr. i. 189.

C. s. horizontalis, Mill. Dict. n. 2. *Cupressus sempervirens* β, L. Sp. Pl. 1422. *Cupressus mas*, Cæsalp. l.c. *Cupressus patula*, Spad. Xilogr. i. 193. *Cupressus sempervirens horizontalis*, Gord. Pinet. 68. *Cupressus expansa*, Targ. Tozz. Obs. Bot. dec. 3-5, 53. *Cupressus orientalis*, hort. *Cupressus Tournefortii*, hort.

Habitat.—The Mediterranean region (where it may be only introduced), especially the Levant and the Greek Archipelago; also westward as far as Persia and the Himalayas. Introduced into England prior to 1548, in which year it is mentioned by Turner in his "Names of Herbes," but much earlier into the South of Europe.

Both forms are wintered indoors.

This Cypress tree is said to produce timber, in its native country, of extraordinary durability. It appears that the doors of St. Peter's Church at Rome were made from the wood of this tree, and they are said to have lasted eleven hundred years. It was also much used by the Egyptians for the manufacture of their mummy-cases. Frequent allusions are likewise made to it in Holy Writ.

C. torulosa, Don, Prodr. Fl. Nep. 55; Lamb. Pinet. ed. 2, 113; Loud. Arbor. iv. 2478, f. 2329-31, and Encycl. of Trees, 1076, f. 1990-2001; Hoffm. Bot. Zeit. 1846, 185; Forb. Pinet. Wob. 189; Fl. Serr. vii. 192 (*cum ic.*); Paxt. Flow. Gard. i. 167, f. 105; Spach, Hist. Vég. Phan. xi. 329; Endl. Syn. Conif. 57; Lindl. and Gord. Journ. Hort. Soc. v. 206; Knight, Syn. Conif. 19; Carr. Man. des Pl. iv. 325; Tr. Gén. Conif. 118, and ed. 2, 150, 151; Gord. Pinet. 69 (excl. syn. *Cashmeriana*). *Juniperus nepalensis*, Loud. Encycl. of Trees, 1118. *Cupressus torulosa*, Don. *Cupressus pendula*, Griffith ex Gord. Pinet. 69. *Cupressus nepalensis*, Loud. Encycl. of Trees, 1118. *Cupressus himalayensis*, hort. *Cupressus Drummondii*, hort. *Cupressus cashmeriensis*, hort. *Cupressus torulosa elegans*, hort. *aliq.* *Cupressus Smithiana*, hort.

Dr. Hooker suggests that *Cupressus torulosa* may be the wild state of the common Cypress, *C. sempervirens*. He also states that it is a rare plant in the Himalayas, and is, moreover, apparently confined to the Western Himalayas. It may perhaps be hereafter found in the eastern part of this range, but it has not yet been so, although Loudon and others have designated it the "Bhotan Cypress." It is found in the province of Gurwal, and there it is in the eastern part of the province. Dr. Jameson says it is abundant there as well as near Kunnoor, and at Surin or Surroo Tota, the place taking its name from the tree. There it occurs in the very bed of the river Dowli, the largest and longest branch of the Ganges. Dr. Royle found it at 11,500 feet above the sea; also in Koonawar, on the borders of Chinese Tartary. Hitherto it has only been found in almost inaccessible situations in the Himalayas, from whence its timber could not be transported to the plains. First discovered and collected by Hamilton in his journey through Nepaul in 1802 and 1803, and described by Don from his specimens in 1825. Since then it remained little known until seeds were sent under the impulse given to the introduction of Himalayan Conifers by the large importations of H.M. Commissioners of Woods and Forests about 1852. It was, however, previously introduced by Dr. Wallich in 1824, and a fresh supply of seeds sent in 1836, and from time to time consignments have reached England, so that there are trees to be met with of various ages. It has been wintered indoors in Denmark.

C. t. Corneyana. *Cupressus Corneyana*, Knight, Syn. Conif. 19; Carr. Tr. Gén. Conif. 128. *Cupressus gracilis*, Gord. Pinet. 117, and Suppl. 23 (excl. syn. *pendula*, Staunt.), not Endl. *Cupressus cernua*, hort. ex Gord. Pinet. Suppl. 23. *Cupressus torulosa gracilis*, hort. *Juniperus chinensis Corneyana*, Gord. Pinet. 117 (excl. syn. Roxb.).

C. t. majestica, Carr. Tr. Gén. Conif. 118; Gord. Pinet. 71. *Cupressus majestica*, Knight, Syn. Conif. 19. *Cupressus flagelliformis*, Knight, l.c. 20.

10. JUNIPERUS.—Linn. Gen. Pl. n. 1134; Juss. Gen. Pl. 413; Gärtn. Fruct. 62, t. 91; Rich. Conif. 137, t. 5, 6; Endl. Gen. 258, n. 1789, and Conif. 7; Spach, in Ann. des Scienc. Natur. ser. 2, xvi. 282, and Hist. des Vég. Phan. xi. 305; Carr. Conif. ed. 2, 7; Gord. Pinet. 91. *Juniperus et Cedrus*, Tourn. Inst. 588, t. 361. *Thujæcarpus*, Trautvett. Imag. Plant. 11. *Arcenthos*, *Juniperus*, and *Sabina*, Antonie die Cupress Gattung, 3, 8, 35; Parl. in D. C. Prodr. xvi. 2, 475; Forb. Pinet. Wob. t. 64, 65; Andr. Bot. Rep. t. 534; Hook. Lond. Journ. ii.; Reichb. Icon. Fl. Germ. t. 536; Guss. Fl. Rar. t. 62; Wis. iii. Pl. Nov. in Mus. Inst. Venet. vi. t. 1; Pall. Fl. Ross. t. 55-57; Traut. Imag. Pl. Ross. t. 15; Sieb. and Zucc. Flor. Jap. t. 126, 127; Mich. N. Am. Sylv.

t. 155 ; Newb. Bot. Williams Exped. t. 10 ; Moggr. Fl. Ment. t. 65 ; Webb. Phytogr. Canar. t. 217 ; Beissn. Nadelh. 103.

Some writers derive the word *Juniperus* from *junepirus*, rough or rude (Celt.), the plants of this genus being stiff shrubs ; or from *juniores pariens*, the young and old leaves and berries being on the plant at the same time ; but the plant, having been used for purposes of abortion, obviously gives its true derivation from *juvenis* and *pario*.

Flowers dioecious. The males, axillary or terminal catkins ; female ones very short, small axillary bud-like bodies, bracteated at the base.

Fruit a globular kind of berry, composed of a fleshy or fibrous juicy substance, covered with a glossy skin more or less furnished externally with minute scales, and sometimes angular and naked at the apex.

Seeds from one to five, but mostly three in each fruit, obscurely three-cornered, and covered with a hard bony covering, having gland-bearing pits towards the base.

Leaves simple, opposite or ternate, lanceolate, scale-like, and either in extended whorls or closely imbricated in four rows.

Cotyledons two.

All evergreen shrubs or small trees, found in the temperate and frigid regions of Europe, Asia, Africa, and America.

The trees and shrubs belonging to this genus generally produce the male and female flowers on separate plants, with the leaves most sharp-pointed, stiff, and usually in whorls of three ; but sometimes they are mere scales, closely imbricated in four rows (as in the Cypress), or occasionally both kinds occur on the same plant at different stages of its growth. The male strobili are small ovate bodies, and either placed at the ends of the branchlets or in the axil of the leaves, and with from four to eight one-celled anthers at the back of each scale. The fertile catkins consist of three fleshy scales, at first nearly concealed by imbricated bracts, from which they gradually rise, grow more succulent, and finally become consolidated into a small, round, fibrous, spongy berry, enclosing from one to three bony seeds, but mostly three, which are convex on one side and angular on the other. The berries (galbules), when ripe, are for the most part either of a deep purple, black, or reddish brown, and when crushed emit a strong resinous smell.

J. Bermudiana, Linn. *Cedrus Bermudæ*, Rai, Letters, 71. *J. oppositifolia*, Moench. Meth. 698. *J. barbadensis*, Linn. ex Gord. Pinet. l.c. (not Mich.). *J. Bermudiana*, Linn. Spec. 1471 ; Hermann, Cat. Hort. Lugdun. Batav. 345 (*cum ic.*), 347 ; Loud. Arbor. iv. 2498, f. 2358 ; Spach, Ann. Sc. Nat. ser. 2, xvi. 301, 698, and Hist. Vég. Phan. xi. 321 ; Hook. in Lond. Journ. of Bot. ser. 2, ii. 141, t. 1 ; Desf. Hist. Arbor. ii. 559 ; Endl. Syn. Conif. 29 ; Lindl. and Gord. Journ. Hort. Soc. v. 202 ; Knight, Syn. Conif. 12 ; Carr. Man. des

Pl. iv. 313, and Tr. Gén. Conif. 49; Gord. Pinet. 101; Henk. and Hockst. Syn. der Nadelh. 328.

Habitat.—Bermuda and North and North-western Bahama Islands, Florida, West Indies, and Canary Islands.

The plant I observed is perhaps not correctly named; it seemed quite hardy and looked beautiful.

From *J. Bermudiana* was obtained the fragrant wood used in the manufacture of "Cedar" pencils, till the increased demand made the tree scarce. There was (1872) still existing in Bermuda an old Cedar tree, the diameter of whose trunk was 58 inches (*Gardeners' Chronicle*, 1872, p. 1035).

J. californica, Carrière. *J. tetragona*, var. *osteosperma*, Torrey in Pacific R.R. Rep. iv. 141; Bot. Mex. Boundary Survey, 210; Ives' Rep. 28. *J. tetragona*, Cooper in Smithsonian Rep. 1858, 263 (not Schlechtendal). *J. Cerrosianus*, Kellog. in Proc. California Acad. 11, 37. *J. occidentalis*, Gord. Pinet. suppl. 38; Pinetum, ed. 2, 162, in part; Henk. and Hochst. Nadelh. 345, in part; Hoopes, Evergreens, 299, in part; Parlatores in De Candolle, Prodr. xvi. 2, 489, in part. *J. californica*, var. *osteosperma*, Engelmann; Watson in Proc. Am. Acad. xi. 119.

Habitat.—California, San Francisco Bay, south through the coast ranges to Lower California.

A small tree, rarely exceeding 20–30 feet in height, with a trunk varying from 1–2 feet in diameter; or more often a tall shrub, sending up many stems from the ground. Sandy barrens and dry, rocky soil (C. S. Sargent, "Forest Trees of North America").

Hardiness doubtful.

J. chinensis, L. Mantiss. 127. *J. barbadensis* and *virginiana*, Thunb. Fl. Jap. 264 (excl. syn.). *J. dimorpha*, Roxb. Fl. Ind. iii. 839. *J. Thunbergii*, Hook. and Arnott, Beechey, 271. *J. dioica*, hort. *Sabina chinensis*, Ant. Cupress. Gatt. t. 75, 76, 78.

Habitat.—Japan, China, Thibet, and the Himalayas of Cashmere and Nepaul.

Introduced in 1804 (Carr. Tr. Gén. des Conif. 31).

J. chinensis has in some Danish gardens attained a height of about 20 feet. One plant recently measured, planted in 1864, has attained a height of 18 feet and a girth of 10 inches.

J. communis, Linn. Spec. 1470 (excl. var. γ); Lamb. Dict. ii. 625 (excl. var. β); Rich. Conif. 33, t. 5; Loisel. Nouv. Duham. vi. 46, t. 15, f. 1 (excl. syn.); Desf. Hist. Arbr. ii. 358; Spach, Hist. Nat. Vég. Phan. xi. 308; Endl. Syn. Conif. 15; Loud. Encycl. of Trees, f. 2013; Lindl. and Gord. Journ. Hort. Soc. v. 200; Knight, Syn. Conif. 11; Carr. Tr. Gén. Conif. 21; Gord. Pin. 93. *Κέδρος*,

Theophrast. Hist. i. 15, 16. *J. minor*, Fuchs, Hist. 78. *J. Dodonæus*, Pempt. 852; Lobel, Ic. ii. 222. *J. vulgaris, baccis parvis purpureis*, J. Bauhin, Hist. i. 2, 293; Rai, Hist. 1411. *J. vulgaris fruticosa*, Bauh. Pin. 488; Tournef. Instit. 589; Duham. Arbr. i. 321, t. 127. *J. communis*, Schkuhr, Handb. t. 333; Engl. Bot. t. 1100; Flor. Dan. t. 1119. *J. communis vulgaris*, Loud. Arbr. Brit. iv. 2489, and Encycl. of Trees, 1801. *J. eracoria*, Lodd. Cat. 1836, 43; Pinet. Wob. 204. *J. communis eracoria*, hort.

Habitat.—Almost all Europe, parts of North America, South Greenland, North Africa, and North Asia as far south as North China. In S. Watson's "Botany," vol. ii., is to be found the following passage: "This Old World species occurs throughout British America, ranging southward on the mountains to North Carolina and New Mexico."

The wood is finely veined, of a yellowish brown, and very aromatic. It weighs, when dry, above 42 lbs. per cubic foot. It makes excellent vine-props, but is generally considered too valuable to be applied to such a use, as from its beauty, and the high polish it will take, it is employed for walking-sticks, cups, and various articles of turnery. It makes excellent fuel, and is used in Scotland and Sweden for smoking hams. The bark is made by the Laplanders into rope. The berries are, however, the most useful product of the Juniper. Many kinds of birds feed on them, and, when burnt, they were formerly thought to possess the power of preventing infection. They are, however, now principally used in making gin, which is simply a spirit distilled from corn and flavoured with an infusion of these berries. When crushed and distilled the berries yield an essential oil. They are used by the peasants in some parts of France to make a kind of beer, which is called "genévrette." For this purpose they take equal parts of barley and Juniper berries, and, after boiling the barley for about a quarter of an hour, they throw in the Juniper berries. They then pour the whole into a barrel half full of water, and bung it closely for two or three days, after which they give it air to promote fermentation. Some persons add molasses or coarse sugar, to make the liquor stronger. This beer is ready to drink in about a week, and it is bright and sparkling, and powerfully diuretic. Apples or pears, slightly crushed, are sometimes substituted for the barley; but the liquor thus made is apt to turn sour, or become vapid, in a short time.

Sir William Hooker observes in his "British Flora": "The berries, which are bluish-black, form an important article of commerce in Holland, where they are employed in the distillation of geneva, and impart to it that peculiar flavour which our distillers try to imitate by oil of turpentine. The wood is reddish, and serves for veneering."

The Juniper is mentioned in the Bible, in the First Book of Kings, as the tree under which the prophet Elijah took refuge in the wilderness

of Beersheba, to avoid the persecution of King Ahab. It was known to the Greeks, who used its berries medicinally, though they thought its shade unwholesome. Pliny says the Juniper has the same properties as the Cedar, adding that, in his time, it grew in Spain to a great size, but that wherever it grows its heart is always sound. He also says that a piece of Juniper wood, when ignited, will, if covered with ashes of the same wood, keep on fire a whole year. It is mentioned by Virgil, who says that its shade is hurtful both to men and corn. The species referred to by the classical writers is in all probability not the common Juniper, but the Phœnician, or some other species of the South of Europe. The botanists of the Middle Ages appear to have had a high opinion of the virtues of the common Juniper. Tragus asserts that its berries will cure all diseases; and Mathioli, that its virtues are too numerous to mention. Turner says that in England the Juniper "groweth most plenteouslie in Kent; it groweth also in the bisshopryche of Durram, and in Northumberlande. It groweth in Germany in greate plentye, but in no place in greater than a lyttle from Bon, where, at the time of year the feldefares fede only of Juniper berries, the people eate the feldefares undrawen, with guttes and all, because they are full of the berries of Juniper" ("Names of Herbes," &c. fol. 25).

J. communis does not generally grow so tall in Denmark as in the other Scandinavian countries. A plant measured in a forest in Jutland in 1882 was 24 feet high; at the same place one plant, measured at breast high, gave a circumference of 3½ feet. Other plants from the Danish islands have been reported to measure about 30 feet in height.

J. communis grows wild in Denmark in different localities. For a long time it was believed to be the only wild-growing Conifer, as all *Pinus silvestris* and *Picea excelsa* are planted, and *Taxus baccata* was first found growing wild in one single locality near Veile, in Jutland, about thirty years ago. It seems natural to suppose that the common Juniper is really hardy, but it is not so. Very often branches, or at least the outer ends of such, are killed by frost, and in exposed localities especially the plant suffers much. In such situations it cannot be used for hedges, and, moreover, plants that are somewhat aged do not stand transplanting very well. During the hard and long winter of 1890-91 *J. communis* was one of the species of Conifers that suffered most. Indeed, among the many species I observed, the following, strangely enough, presented the most wretched appearance as old plants: *Sequoia gigantea*, *Taxus baccata*, *Pinus Laricio*, *Abies pectinata*, and *J. communis*. I have been informed from North Sweden and Finland that there *J. communis* also looked much damaged, and that it often does so.

Of this species there are to be found pieces of stems in the Botanic Museum at Christiania showing an age of nearly 280 years.

In Scandinavia this Juniper thrives better than farther south in Central Europe. In the South of Norway it is common to see trees of more than 20 feet high, and which, breast high, are 6 to 9 inches in diameter.

In East Finland, at 69° N. lat. and 23° 40' E. long., the geologist Tellef Dahl found very low growing *J. communis*, with horizontal branches of a length of 10 to 12 feet. The short stems were 13 inches in diameter. The annular rings were so fine that it was impossible to count them (Schübeler, "Viridarium Norvegicum").

J. c. pyramidalis, a variety to be seen in some Danish gardens having a height of about 25 feet.

J. drupacea, Labill. Pl. Syr. Decad. ii. 14, t. 18. *J. latifolia arborea*, *Cerasi fructu*, Tourn. Coroll. 41. *J. Oxycedrus* γ, Lamb. Dict. ii. 625. *Arceuthos drupacea*, Ant. and Kotsch. Oest. Bot. Wochenbl. iv. 249 (1854).

Habitat.—The mountains of Northern Syria (2,000–5,000 feet high), different parts of Mount Taurus, and places in Western Asia at from 3,500 to 5,000 feet elevation, and in Greece, especially on the Peloponessus.

Introduced into North and West European gardens in 1854 by Theodor Kotschy.

Has in some gardens grown well out of doors during many years, but occasionally, here and there, branches were killed.

J. excelsa, Bieb. Fl. Taur. Cauc. ii. 524. *J. Sabina*, var. *taurica*, Pall. Fl. Ross. ii. 15. *J. foetida excelsa*, Spach in Ann. Sc. Nat. ser. 2, xvi. 297. *J. Olivieri*, Carr. Tr. Gén. Conif. 57. *J. (?) excelsa*, Madd. in Gord. Pin. 107. *J. (?) religiosa*, Royle, Himal. Mount. i. 351. *J. excelsa glauca*, hort. *J. polycarpa* and *J. isophylla*, C. Koch, Dendrol. ii. 133. *Sabina excelsa*, Ant. Cupress. Gatt. 45, t. 60.

Habitat.—The Greek Archipelago, and the sub-alpine districts of Asia Minor; also Armenia and Syria (Mount Lebanon), (Prod. xvi. 484).

Introduced in 1806 by Sir Joseph Banks.

Perhaps not quite hardy in Denmark.

J. flaccida, Schlechtendal. *J. foetida flaccida*, Spach, Ann. Sc. Nat. ser. 2, xvi. 300, and Hist. Vég. Phan. xi. 320; Loud. Encycl. of Trees, 1090; Carr. Man. des. Pl. iv. 313, and Tr. Gén. Conif. 48; Gord. Pin. 103 (excl. syn. *gracilis*).

Habitat.—Different parts of Mexico.

Introduced in 1838.

Grown in pots in Denmark. A large shrub which I saw under this name in South Sweden does well out of doors, but it will still have to be observed if it is the true species.

J. foetidissima, Willd. Spec. Pl. iv. 853. *J. orientalis foetidissima*, &c., Tourn. Coroll. 41. *J. foetida squarrulosa*, Spach in

Ann. Sc. Nat. ser. 2, 300. *Sabina foetidissima*, Aut. Cupress. tab. 66-71.

Habitat.—On Greek mountains from 5,000-6,500 feet in height, in Macedonia, Asia Minor, Syria, Caucasus, Armenia, and Cyprus.

The specimen observed may not be correctly named.

J. macrocarpa, Siebth. Fl. Græc. Prodr. ii. 263. *J. Oxycedrus* β , Lamb. Dict. Encycl. ii. 625. *J. Lobeli*, Guss. Syn. Fl. Sic. ii. 635. *J. maximus illyriacus*, Lob. Ic. ii. 225. *J. Piasoletti*, Lk. Sitzungsber. d. Ges. Nat. Fr. (Berlin, Feb. 1845). *J. attica*, Orph. in Heldr. Nutzpfl. Griechl. 13. *J. oblongata*, Guss. Pl. Exsicc. *J. neohoricensis*, Laws. ex Gord. Pin. 95. *J. Willkommii*, Aut. Cupress. Gatt. 9, t. 7. *J. sphaerocarpa*, Aut. Cupress. Gatt. 11, t. 10. *J. communis macrocarpa*, Spach, Ann. des Sc. Nat. ser. 2, xvi. 290.

Habitat.—South Europe, North Africa, in Cyprus and in Syria; mostly on mountains. Abundant in Mediterranean regions.

May be hardy.

J. nana, Willd. Spec. Pl. iv. 854. *J. alpina*, Clus. Hist. Pl. i. 38. *J. dealbata*, Dougl. (not Loud.). *J. nana* β *alpina*, Endl. Syn. Conif. 14. *J. sibirica*, Burser. Anleit. &c. ii. 272. *J. alpina suecica*, Plukn. Almag. 201. *J. sacatilis*, hort. *J. communis* γ , L. Spec. 1470. *J. communis* β , Lamb. Dict. ii. 625. *J. communis montana*, Ait. Hort. Kew. ed. 1, iii. 414. *J. communis alpina*, Gaud. Fl. Helvet. vi. 301. *J. communis nana*, Loud. Arb. and Frut. Brit. iv. 2486. *J. montana*, hort. *J. alpina minor*, hort. *J. daurica*, hort. (not Pall.). *J. minor montana*, C. Bauh. Pin. 488. *J. prostrata*, Holland.

Habitat.—In alpine and sub-alpine regions in Europe, North Asia, North America, South-east and South-west Greenland, on Scandinavian mountains, in Scotland, England, and the Pyrenees; very common in Spain, on the Alps and the Apennines; in Thrace, Macedonia; on Siberian mountains, Kamtschatka, &c. It often grows on boggy ground. As to its distribution in North America, S. Watson says in his "Botany," ii. 113: "The variety is found in the Sierra Nevada (Mono Pass, Brewer), and in the northern coast ranges (Del Norte County, Bolander), as well as eastwards to Maine, and is scarcely more than a reduced form of the species."

J. occidentalis, Hook. Fl. Bor. Amer. ii. 166. *J. Hermannii*, Pers. Syn. ii. 632. *J. excelsa*, Lew. in Pursh. Fl. Bor. Amer. ii. 647. *J. andina*, Nutt. N. Amer. Sylv. iii. 95, t. 110. *J. pyramidalis*, Lindl. Gard. Chron. 1855, p. 420. *J. dealbata*, hort. (not Loud.). *J. (?) fragrans*, Knight, Syn. Conif. 13. *Juniperi* species, Sierra Nevada, hort. *Chamaecyparis Boursierii*, Decaisne in Bull. Soc. Bot. de France, i. 70.

Habitat.—Blue Mountains and high prairies of Eastern Washington

Territory and Oregon, Cascade Mountains of Oregon, valley of the Klamath River, California, and south along the high ridges of the Sierra Nevada, between 7,000 and 10,000 feet elevation, to the San Bernardino Mountains (Parish Bros.).

A tree 30-50 feet in height, with a trunk 4-7 feet in diameter, or often a low, much-branched shrub; dry, rocky ridges and prairies, reaching its greatest development in the Californian sierras (C. S. Sargent, "Forest Trees of North America").

It appears to be hardy.

J. Oxycedrus, L. Spec. Pl. 1470. *J. rufescens*, Lk. in Fl. Ann. 1846, 579. *J. tenella*, Ant. Cupr. Gatt. 20, t. 27, 29. *J. Marshalliana*, Stev. Pl. Exsicc. *J. Wittmanniana*, hort.

Habitat.—Mediterranean countries, in North Africa; also on the Alps up to 6,500 feet.

It seems to be hardy.

In France an essential oil is distilled from its wood, called *huile de cade*, which is used in veterinary medicine.

J. phœnicea, L. Spec. Pl. 1471. *J. Lycia*, L. Spec. Pl. 1461. *J. tetragona*, Mönch. Meth. 699. *J. Langoldiana*, hort. *Cupressus Devoniana*, hort. *Sabina phœnicea*, Ant. Cupress. Gatt. 42, t. 57.

Habitat.—The Mediterranean region, in South Europe, West Asia, and North Africa.

Introduced in 1683 by Mr. James Sutherland, of the Botanic Garden, Edinburgh.

J. pseudo-Sabina, Fisch. and Mey. in Ammad. ad Ind. 8; Sem. Hort. Petrop. 15. *J. Sabina*, Led. Fl. Alt. iv. 298. *J. Wallishiana*, Hook. fil. Herb. Kew.

Habitat.—In Siberia, Songori, on Altai and Baikal Mountains; in Thibet, often up to 13,000 feet. It is hardy.

J. recurva, Hamilt. in Don, Prodr. Fl. Nepal. 55. *Sabina recurva*, A. S. Oersted, Frilands-Trævæxten i Danmark, i. 8 (1864). *J. recurva pendula*, hort. *J. repanda*, hort. *J. nepalensis*, hort. *J. canescens*, Comp. Ind. *J. squamata*, Ham., var. *recurva*, C. Koch, Dendrol. ii. 122.

Habitat.—This Juniper is a native of the Himalayas, Cashmere, Bhotan, and Nepaul, where it was found by Dr. Hamilton, who designated it by the appellation of *J. recurva*, in consequence of the recurved habit of growth of the plant. It is quite hardy, and is readily distinguished from all the others by its pendulous branches.

Introduced into Europe in 1822.

J. r. densa, Carr. Man. des Pl. iv. 310; Conif. 27. *J. densa*, Gord. Pinet. suppl. 32. *J. recurva nana*, hort. *J. communis indica*, Madd. ex Gord. l.c.

J. r. squamata, Parl. in D. C. Prodr. xvi. 2, 482. *J. squamata*, Hamilt. Don in Lanub. Pinet. ed. 2, ii. 133. *J. recurva* β *squamata*, Hook. Pl. Exsicc. *J. squamata recurva*, C. Koch, Dendrol. ii. 122. *J. Lambertiana*, Wall. Mss. *J. dumosa*, Wall. ex Gord. Pinet. suppl. 32. *Sabina squamata*, A. S. Oersted, Frilands-Trævæsten i Danmark, 1864, i. 8. *J. squamata*, Herb. Hamilt. *Sabina squamata*, Ant. Cupress. Gatt. t. 89, 90.

Habitat.—The Himalayas, chiefly in Nepaul and Thibet, at elevations of from 10,000 to 15,000 feet (Veitch, Man. of Conif.).

Introduced into England in 1824.

J. religiosa, Royle, Fl. Himal. Mount. i. 351. *J. erecta*, Madd. in Gord. Pinet. 107. *J. (?) chinensis*, Parl. in D. C. Prodr. xvi. 2, 488. *Sabina religiosa*, Ant. Cupress. Gatt. t. 60, 62. *Sabina religiosa*, A. S. Oersted, Frilands-Trævæsten i Danmark, 1864, i. 5.

Habitat.—On the highest mountains of the Himalayas. It is said not to descend below 6,500 feet. May be hardy.

J. rigida, Sieb. and Zucc. Fl. Jap. ii. 109, t. 125. *J. communis*, Thunb. Flor. Jap. 264 (excl. syn.).

Habitat.—Japan, on the Island of Nippon; on Mount Hakane, 3,250–3,900 feet; at Atame on the east coast, and under cultivation.

Introduced into England in 1861 by Mr. J. G. Veitch.

J. Sabina, Linn. Spec. Pl. 1472 (excl. var. β). Willd. Sp. in Not. 4, 852; Fisch. Plant. Schrenk. ii. 13; Duham. Arbr. 2, t. 62; Desf. Hist. Arbr. ii. 559; Loisel. Nouv. Duham. vi. 48; Schouw, Ann. Sc. Nat. 1845, 245; Endl. Syn. Conif. 22; Lindl. and Gord. Journ. Hort. Soc. v. 201; Knight, Syn. Conif. 12; Carr. Tr. Gén. des Conif. 34; Gord. Pinet. 109. *J. Sabina*, *A. vulgaris*, *erecta*, *pyramidato dumosa*, Endl. Syn. Conif. 22. *Sabina*, *folio Cupressi*, Bauh. Pin. 487; Duham. Arbr. ii. 242, t. 63. *Juniperus*, nr. 33, Gmel. Flor. Sibir. i. 182. *J. Sabina cupressifolia*, Ait. Hort. Kew. ed. 1, iii. 414; Loud. Arbor. Brit. iv. 2499, f. 2359. *J. Sabina stricta*, hort. *J. Sabina horizontalis*, hort. *J. davurica*, Pallas, Fl. Ross. ii. 13, t. 55; Andrews, Bot. Reposit. t. 534; Ledeb. Fl. Alt. iv. 299; Endl. Syn. Conif. 19. *J. fetida davurica*, Spach in Annal. Sc. Nat. ser. 2, xvi. 296. *J. fetida Sabina*, Spach in Ann. Sc. Nat. ser. 2, xvi. 295. *J. Sabina*, *A. vulgaris*, Endl. Syn. Conif. 22. *J. lusitanica*, Mill. Diet. n. 11. *Sabina officinalis*, Gareke, Flor. Mitth. und Sud Deutschl. 1858, s. 387. *Sabina vulgaris*, Ant. Cupress. Gatt. tab. 80, 82. *Sabina fetida*, A. S. Oersted, Frilands-Trævæsten i Danmark, 1864, i. 6.

Habitat.—The sub-alpine districts of Southern and Middle Europe, from the Pyrenees to the Caucasus, in Siberia, and in Asia Minor. Introduced into England prior to 1548, as it appears in Turner's "Names of Herbes," published in that year.

The Savin, though generally seen in gardens as a low spreading shrub, has sometimes an upright trunk, clothed in a reddish-brown bark, and rising to the height of 10 or 12 feet, or even higher. Its branches are nearly straight, very much ramified, and form, with the trunk, a regular pyramid. Its young branches are entirely covered with imbricated leaves, which have a very strong and disagreeable odour, and a very bitter taste. The berries are smaller than those of the common Juniper, but of the same colour, and a little compressed. The leaves of the Savin are used in medicine as a diuretic; but if taken in large quantities during pregnancy, as well in the human species as in domestic animals, will produce abortion. When dried and pulverised, they are used for cleansing foul ulcers. The upright Savin was formerly much used in England, and still is in some parts of France in topiary work, as it bears the shears very well. In France it is employed in the same manner as the common Juniper, to form screens (*rideaux de verdure*) and to cover walls which it is wished to conceal. The Baschkirs, a people of Russia between the Volga and the Oural, use fumigations of Savin to cure the diseases of children; they also believe it to have a great effect against witches, for which purpose they hang branches of it at the doors of their houses. The ancient Germans, it is said, gave Savin to their chargers to give them ardour. Hardy in Denmark.

J. S. prostrata, Loud. Encycl. of Trees, 1086. *J. prostrata*, Person. *J. repens*, Nutt. Gen. Amer. ii. 245. *J. alpina*, Lodd. Cat. 1836. *J. Sabina tamariscifolia*, hort. aliq. non Ait. *J. Sabina prostrata*, Knight, Syn. Conif. 12. *J. hudsonica*, Forb. Pinet. Wob. 208. *J. Sabina*, Michx. Fl. Bor. Amer. ii. 246. *J. horizontalis*, Moench. Meth. 699. *J. Sabina alpina*, Loud. Arbor. iv. 2499, f. 2361, 2362. *J. Sabina multicaulis*, Spach, Ann. Sc. Nat. ser. 2, xvi. 295. *J. prostrata*, Pers. Syn. ii. 632; Spach, Ann. Sc. Nat. ser. 2, xvi. 293, and Hist. Vég. Phan. xi. 314; Endl. Syn. Conif. 18; Lindl. and Gord. Journ. Hort. Soc. v. 200; Carr. Man. des Pl. iv. 310, and Tr. Gén. Conif. 26; Gord. Pinet. 106. *J. (?) racemosa*, Risso. Hist. Nat. Eur. MÉR. ii. 459. *J. (?) casia*, Carr. ed. 2, 53. *J. repanda*. *Sabina prostrata*, Ant. Cupress. Gatt. 76, 82.

Habitat.—In North America, on sandy coasts, near the Great Lakes and in the West, on the Rocky Mountains. It is hardy.

J. S. tamariscifolia, Ait. Hort. Kew. iii. 414. *Sabina, folio tamarisci*, Bauh. Pinet. 487. *J. Sabina* β , Linn. Spec. 1472. *J. Sabina*, Mill. Dict. 10. *J. fastida* β *tamariscifolia*, Spach, Ann. Sc. Nat. ser. 2, xvi. 295 (excl. syn. Pall.). *Sabina tamariscifolia*, A. S. Oersted, Frilands-Trævæxten i Danmark, 1864, i. 6.

J. sabinoides, Gris. Spicileg. Fl. Rumel. ii. 352. *J. sabina mas*, hort.

Some authors call this plant *Juniperus Sabina tamariscifolia*. I

have not yet sufficiently observed our plant, and for a time intend to keep it under the above name.

Habitat.—Spain and other parts of S. Europe, Sicily, Roumelia, Greece. It seems to be hardy.

J. sphærica, Lindl. in Paxt. Flow. Gard. i. 58, f. 35. *J. Fortunei*, Van Houtte. *J. chinensis Smithii*, Loud. ex Gord. Pin. *J. Sabina sphærica*, A. S. Oersted, Frilands-Trævæxten i Danmark, 1864, i. 5.

Habitat.—North China.

Introduced by Fortune in 1846.

Hardy.

J. thurifera, L. Sp. Pl. 1471. *J. hispanica*, Lamb. Dict. Encycl. 626. *J. foetida thurifera*, Spach, Ann. Sc. Nat. ser. 2, xvi. 298. *J. sabinoides*, Endl. Conif. 24 (not Gris.). *J. cinerea*, Carr. Tr. Gén. Conif. 35.

Habitat.—Spain, on the Sierra Nevada in Andalusia; Portugal, near Cape St. Vincent; Algiers, near Medina (Prodr. xvi. 487).

Introduced into England in 1752 by Miller.

Seems to be hardy.

J. virginiana, L. Sp. Pl. 1471. *J. foetida virginiana*, Spach, Ann. Sc. Nat. ser. 2, xvi. 297, and Hist. Vég. Phan. xi. 318. *J. arborescens*, Moench. Meth. 699. *J. caroliniana*, Dur. Harbk. (Pott.) i. 497. *Sabina virginiana*, Ant. Cupress. Gatt. tab. 83, 84.

Habitat.—Southern New Brunswick to the northern shores of Georgian Bay, Northern Michigan, Wisconsin and Minnesota; south to Cape Malabar and Tampa Bay, Florida, and the valley of the Colorado River, Texas; west to Eastern Nebraska, Kansas, and the Indian Territory to about the one-hundredth parallel of west longitude; in the Pacific region, Rocky Mountains of Colorado to Vancouver's Island, British Columbia; not extending to Western Texas, California, or Oregon; in Utah, Nevada, and Arizona rare and local.

The most widely distributed of North American Conifers; a tree 80–100 feet in height, with a trunk 2–4½ feet in diameter, or toward its northern and western limits much smaller, often reduced to a low shrub; dry, gravelly ridges and limestone hills, or in the Gulf States, especially near the coast, in deep swamps; in Northern Montana, borders of streams and lakes; common, and reaching its greatest development, in the valley of the Red River, Texas.

Wood light, soft, not strong, brittle, very close and straight-grained, compact, easily worked, very durable in contact with the soil; odorous; bands of small summer cells rather broad, conspicuous; medullary rays numerous, very obscure; colour dull red, the thin sapwood nearly white; specific gravity, 0.4926; ash, 0.13; largely

used for posts, sills, railway ties, interior finish, cabinet-making, and almost exclusively for lead-pencils (C. S. Sargent, "Forest Trees of North America"). A decoction of the leaves is occasionally used as a substitute for savine cerate, and an infusion of the berries as a diuretic (U.S. Dispensatory, ed. 14, 526 ; Nat. Dispensatory, ed. 2, 795).

The trunk decreases so rapidly in diameter as it ascends that the largest specimens rarely afford timber for shipbuilding more than 11 feet in length. The diameter of the wood is also very much diminished by deep oblong furrows in every part of the trunk, occasioned by the large branches persisting after they are dead (Michx.).

The Red Cedar derives its name from the beautiful red heart of the wood, which is much prized in its native country for the manufacture of various articles of turners' work. Michaux describes the wood of the tree as being pre-eminent for subterranean pipes, but it is seldom used for that purpose in consequence of it being difficult to procure stems of a sufficient diameter, and as it is daily becoming scarcer it is reserved for more important purposes. Its foliage, when dried and reduced to powder, is frequently used for increasing the efficacy of blister-plaster. Its leaves have also been successfully applied for rheumatism and dropsy, when taken in doses of one or two scruples.

The economic value of the wood of the Red Cedar is very great, and the uses to which it is applied in America are numerous. The matured or heart wood is of a fine red colour, whence the popular name of the tree ; it is of close texture and fine in grain, admitting of a high polish ; it is also very fragrant, on which account it is employed in cabinet work and inlaying ; it is durable and free from the attacks of insects ; it resists for a long time the action of water, and was much used by the earlier colonists and settlers for water-shoots, stakes, and underground work (Loud. Arb. et Frut. p. 2497, ex Michaux). But the tree does not in general attain a sufficient size to yield planks of more than a few inches in breadth and thickness, which has proved an impediment to its more extensive use for constructive purposes. The chief use made of the wood in England is in the manufacture of "Cedar pencils," but even for this purpose the wood of the Bermuda Juniper has hitherto been preferred, but it is now becoming too scarce to supply the demand (Loud. Arboret.).

J. virginiana, in about fifty years, has in Danish gardens attained a height of 40 feet. A plant lately measured, planted in 1845, has attained a height of 25 feet ; another, planted in 1864, is 20 feet high.

J. v. Bedfordiana, Knight, Conif. 12. *J. v. barbadensis*, Gord. Pin. 114. *J. v. β australis*, Endl. Conif. 28. *J. Bedfordiana*, hort. *J. gracilis*, hort. *J. Gossainthanea*, Lodd. Cat. ; Loud. Encycl. of Trees, 1090. *J. virginiana caroliniana*, Loud. Encycl. of Trees, 1048. *J. v. Gossainthanea*, Carr. Tr. Gén. Conif. ed. 2, 45.

The origin of this beautiful variety is not known with certainty.

Mr. Gordon (Pinetum, p. 156) states that it is a native of Barbados and other West Indian islands, but quotes no authority in support of the statement. It was extensively distributed by Messrs. Loddiges under the name of *Juniperus Gossainthaniana*, thereby indicating a Himalayan origin, which is accepted by M. Carrière (Traité, p. 45), but rejected by Professor Parlatores, who considers it to be a garden variety only (Veitch, Manual).

TREE II.—*TAXODIÆÆ*.

11. CRYPTOMERIA.—Don in Linn. Trans. xviii. 2, p. 166; Brongn. in Ann. des Sc. Nat. ser. 2, xii. 231; Sieb. and Zucc. Fl. Jap. ii. 41; Endl. Conif. 71; Carr. Tr. Gén. Conif. 153; Gord. Pin. 52. Cupressi sp. Linn. fil. Suppl. 421; Thumb. Fl. Jap. 265. Taxodii sp. Brongn. in Ann. des Sc. Nat. ser. 1, xxx. 183 (except var. β); Parl. in D. C. Prodr. xvi. 2, 437; Carr. Tr. Gén. Conif. 191; Koch, Dendr. ii. 188; Henk. and Hochst. Syn. der Nadelh. 266; Eichl. in Engl. and Prantl. Natürl. Pfl. ii. 89.

Flowers monœcious; the male catkins numerous, somewhat oblong, and collected in clusters at the extremities of the branchlets; the female ones mostly solitary, or two or three together, without footstalks, spherical and terminal.

Cones almost globular, woody, and either singly or in clusters. They are developed and ripen in one year.

Scales wedge-shaped, numerous, loose, and with rough-fringed edges.

Seeds from three to five under each scale, obovate or angularly depressed, and covered with a crustaceous tegument, prolonged on each side into a regular membrane, cut sloping at both extremities.

Cotyledons from two to four in number, but mostly in threes.

Leaves alternate, in five rows, sickle-shaped, irregularly four-sided, without any footstalks, but running downwards at the base, acute-pointed, spreading, and persistent.

Name derived from *kryptos*, hidden, and *meris*, a part.

Only one species. A large evergreen tree or small shrub; found in the north and east of China and in Japan.

C. japonica, Don, l.c. *C. Fortunei* (Hooibrenk), C. Koch, Dendr. ii. 190. *Cupressus japonica*, Linn. fil. Suppl. 421. *Taxodium japonicum*, Brongn. in Ann. des Sc. Nat. ser. 1, xxx. 183 (excl. var. *heterophylla*).

Habitat.—Japan. Abundant on some of the mountain slopes, where it constitutes the chief part of the forests, from their base to an elevation of 1,500 feet; also frequent in China under cultivation.

Introduced into England in 1844 by the Royal Horticultural Society through their collector, Mr. Robert Fortune, who sent seeds from Shanghai (*Gardeners' Chronicle*, 1845, p. 344).

C. j. elegans, hort. *C. elegans*, Veitch.]

Introduced from Japan in 1861 by Mr. J. G. Veitch, who met with it only in cultivation in the neighbourhood of Yokohama.

C. j. Lobbii, hort. *C. Lobbii*, hort.

This variety differs in nothing from the original, except in its being of a much brighter green colour and of more compact growth. It is said to have been introduced from the Dutch Botanic Gardens at Batavia by one of the Lobbs.

C. j. nana, Fortune, the dwarf Japan Cedar. *C. j. pygmaea*, Loud.

This variety seldom attains a greater height than 2 or 3 feet, and very much resembles a small Juniper bush in its stunted habit, forming quite a dense bush with twisted or erect leaves, recurved at the points.

A little bush, called by the Chinese "Fi Suga" (dwarf evergreen).

C. j. spiralter falcata, Sieb. Fl. Jap. t. 125. *C. spiralter falcata*, hort.

A very curious variety, of slender habit. The falcate leaves are so closely adpressed as to give them the appearance of a spiral thread wound round the branchlets. This variety is most often cultivated in stove or greenhouses, but I have reason to think it is almost as hardy as some of the other *Cryptomerias*. It has kept well out of doors, slightly covered.

C. j. variegata.

This variety is beautifully variegated with pale yellow, and when in good condition a very attractive kind.

The *Cryptomeria* is one of the finest trees in Japan. For centuries past it has received assiduous attention from Japanese horticulturists, who possess many useful and interesting varieties of it, including those above described. It is not only common in gardens throughout the country, but it is also planted to form avenues along the public roads, especially along the approaches to spots associated with important historic personages or events. One of the finest of these avenues, and probably one of the most remarkable of its kind in the world, is that leading from the town of Namada through Ontsonomeya to Nikko, celebrated as the burial-place of one of the greatest of Japanese rulers in former times. This avenue extends for a distance of fifty miles, and consists chiefly of *C. japonica*, the trunk of every tree being as straight as an arrow, and averaging from 130 to 150 feet in height, by 12 to 15 feet in circumference at the base. The avenue is not straight the whole distance, but has many windings, which enhances its effect. It was planted by one of the old feudal lords about three hundred years ago, and was presented by him to the then Shogun, or military ruler of the country. There is another fine avenue of *Cryptomerias* on the Hakoni road to Fusi-

Yama, extending for several miles (Veitch, "Manual of Conifers," 1881, p. 220).

C. japonica is in several parts of Denmark to be found of about thirty years of age, and of a height of about the same number of feet. Here and there it is seen well developed even in exposed situations. Cone-bearing plants are also occasionally seen.

12. TAXODIUM.—Rich. in Ann. Mus. (1810), xvi. 298, and Conif. 143, t. 10; Endl. Conif. 66; Carr. Conif. 143; Gord. Pinet. 305. Cupressi spec. Linn. Sp. Pl. 1422, and pl. auct. Schubertia, Mirb. in Nouv. Bull. de la Soc. Philom. (1813), iii. 121; Spach, Hist. des Vég. Phan. xi. 347. Taxodii spec. Brongn. in Ann. des Scienc. Nat. ser. 1, xxx. 177, 182; Endl. Gen. Pl. 259. Glyptostrobi spec. Endl. Conif. 71; Carr. Conif. 152; Parl. in D. C. Prodr. xvi. 2, 440; Lamb. Pin. ed. min. t. 63; Forb. Pinet. Wob. t. 60; Nutt. N. Am. Sylv. t. 151; Eichl. in Engl. and Prantl. Natürl. Pflf. ii. p. 90; Ann. Mus. xvi. 298; Conif. 52, t. 10; Nouv. Duham. iii. 8; Robin, Voyages, iii. 525; Lamb. Pin. ed. 2, iii. 180, t. 80; Torr. Compend. Fl. N. States, 361; Bot. Mex. Boundary Survey, 210; Loud. Arbor. iv. 2481, f. 2335-39; Engelmann and Gray in Journ. Boston Soc. Nat. Hist. v. 234; Scheele in Roemer, Texas, appx. 447; Lindl. and Gord. in Journ. Hort. Soc. London, v. 209; Knight, Syn. Conif. 20; Darlington, Fl. Cestrica, ed. 3, 295; Morren in Belg. Hort. vi. 74 and t.; Loud. Gard. Chron. 1857, 549; Cooper in Smithsonian Rep. 1858, 257; Chapman, Fl. S. States, 435; Curtius in Rep. Geolog. Surv. N. Carolina, 1860, iii. 29; Lesquereux in Owen's Second Rep. Arkansas, 389; Wood, Cl. Book, 663; Bot. and Fl. 315; Gray, Man. U. States, ed. 6, 493; Hoopes, Evergreens, 364 f.; Lawson, Pinet. Brit. ii. 305, f. 1-9; Fowler in London Gard. Chron. (1872), 1526; Young, Bot. Texas, 518; Bertrand in Bull. Soc. Bot. France, xviii. 127; Broadhead in Coulter's Bot. Gazette, iii. 60; Veitch, Man. Conif. 214; Ridgway in Proc. U.S. Nat. Mus. 87; Watson in Proc. Am. Acad. xviii. 158; Beissner, Nadelholzk. 148.

Flowers monœcious; the male ones in compound pyramidal spikes, the female two or three together, near the base of the spike of male flowers.

Cones globular, ligneous, and with an uneven surface.

Scales imbricated spirally, thick, and raised in the centre.

Seeds irregularly shaped, woody, and two at the base of each scale.

Leaves in two rows, flat, linear, and deciduous.

Cotyledons from five to nine in number.

Name derived from *τάξος* (Yew) and *είδος* (like), from its supposed resemblance to the common Yew.

Deciduous trees, found in North America and Mexico.

T. distichum, Rich. in Ann. Mus. xvi. 298, and Conif. 143, t. 10. *T. distichum patens*, Endl. *T. nigrum*, hort. *Schubertia disticha*, Mirb. Spach, Hist. des Vég. Phan. xi. 349, excl. pl. Mexic. *Cupressus virginiana Tradescanti*, Rai, Hist. Pl. ii. 1, 408. *Cupressus virginiana fol. Acaciae cornigeræ paribus et deciduis*, Plukn. Almag. 125, t. 85, f. 6. *Cupressus americana*, Catesb. Carol. i. 11, t. 11. *Cupressus disticha*, L. Sp. Pl. 1422. *Cupressus disticha patens*, Ait.

Introduced into Europe about 1640.

Habitat.—Sussex County, Delaware; south near the coast to Mosquito Inlet and Cape Romano, Florida; west through the Gulf States near the coast to the valley of the Nueces River, Texas, and through Arkansas to Western Tennessee, Western and Northern Kentucky, South-eastern Missouri, and Southern Illinois and Indiana.

A large tree of great economic value, 80–150 feet in height, with a trunk 6–13 feet in diameter; deep, submerged swamps, river bottom lands, and pine-barren ponds; common, and forming extensive forests, in the South Atlantic and Gulf States (C. S. Sargent).

Wood light, soft, close, straight-grained, not strong, compact, easily worked, very durable in contact with the soil; bands of small summer cells broad, resinous, conspicuous; medullary rays numerous, very obscure; colour light or dark brown, the sapwood nearly white; specific gravity, 0.4543; ash, 0.42; largely manufactured into lumber and used for construction, cooperage, railway ties, posts, fencing, &c.; often injured, especially west of the Mississippi River, by a species of *Dædalia*, not yet determined, rendering it unfit for lumber. Two varieties of Cypress, black and white, are recognised by lumbermen, the wood of the former heavier than water when green, rather harder and considered more durable than the other; the unseasoned wood of the latter lighter than water, and rather lighter coloured than the black Cypress (C. S. Sargent, "Forest Trees of North America").

The deciduous Cypress appears to have been introduced before 1640, as Parkinson, writing in that year, speaks of it. "The Americane cypresse is, as it is said, in sundrie countries of the North America; its seed was brought by Master Tradescant from Virginia, and sown here, and doe spring very bravely" (Park. Theat. &c. p. 1477). Miller, speaking of this tree, says: "One in the gardens of John Tradescant, in South Lambeth, near Vauxhall, is upwards of 30 feet high, and of considerable bulk; and though in a common yard at present, where no care is taken of it, but, on the contrary, many hooks are driven into the trunk to fasten cords thereto for drying clothes, yet the tree is in great health and vigour, but has not produced any fruit as yet, which may be occasioned by want of moisture; for we often see aquatic plants will grow upon a drier soil, but yet are seldom so productive of either flowers or fruit as those which remain in the water" (Dict. ed. 1731).

Taxodium distichum has nowhere in Denmark attained such an age and development as to be able to show its interesting root-knots, or "knees," such as are to be seen in their fine development at Syon House, near Kew, and perhaps in other parts of Great Britain, and in some localities on the Continent, especially in France. But still very nice plants are to be seen in Denmark, where there are specimens of 40 feet high and more. Near Copenhagen a fine plant is to be seen near Aurenhoi on the Strandvej; nice trees have also developed themselves well at Aalholm on the island of Lolland, at Tranekjör on the island of Langeland, and at Damgaard in Jutland.

In the Botanic Gardens at Hamburg I have seen several still larger plants; but on inquiry it was said that the plants produced no cones.

Taxodium distichum does not thrive well in Southern Norway. In Sweden it is rare, and perhaps not cultivated out of doors farther north than the southern parts of the continent and on Gothland.

T. d. pendulum. Whether this is a *Glyptostrobus* or not still remains to be determined.

T. mexicanum, Carr. Conif. ed. 2, 186, Mexicanische Sumpfcypresse. *T. mucronatum*, Ten. Osserv. su di una piant. Conif. del Gen. *Taxodium* (Modena, 1853), t. 1 and 2. *T. distichum*, H. B. et Kth. Nov. Gen. et Spec. Pl. ii. 4. *T. Montezumce*, Deene. Bull. Soc. Botan. 1854, i. 71. *T. distichum mexicanum*, Gord. Pinet. 307. *T. distichum pinnatum*, hort. *T. pinnatum*, hort. aliq. *T. distichum virens*, Knight, Syn. Conif. 21. *T. distichum excelsum*, Both. ex Gord. Pinet. Suppl. *T. virens*, hort. *T. Huegli*, Laws. ex Gord. Pinet. l.c. *Cupressus disticha sempervirens*, Rinz. ex Gord. Pinet. Suppl. l.c.

Habitat.—In temperate Mexico, where it forms large forests on mountains at an elevation of from 5,000 to 8,000 feet. In the city of Mexico enormous and grand trees are to be found.

Introduced into Europe about 1840, or before. Has not proved hardy in Denmark.

13. GLYPTOSTROBUS.—Endl. Conif. 69 (except sp.); Carr. Conif. 450 (except sp.); Gord. Pinet. 89. *Thuya* spec. Poir. Dict. Encycl. v. 305; Staunt. Embassy to China, 436; Lamb. Pinet. ed. 2, 115. *Taxodii* spec. Brongn. in Ann. des Scienc. Nat. ser. 1, xxx. 184, and ser. 2, xii. 232. *Schuberti* a spec. Spach, Hist. des Vég. Phan. xi. 352.

Flowers monœcious; male flowers perhaps not yet described; female, ovate catkins on the end of small side-branches.

Cones ovoid, ligneous; the scales soon fall off.

Seeds two, upright, ovoid, depressed; ripen in one year.

This genus is only to be found in China. By some authors it is referred to the genus *Taxodium*.

G. heterophyllum, Endl. Syn. Conif. 70. *Thuya lineata*, Poir. Dict. suppl. v. 305. *T. lineata* β *lavandulæfolia*, Poir. l.c. *T. pensilis*, Staunt. Embassy to China, 436. *Taxodium japonicum*, β *heterophyllum*, Brongn. l.c. *Taxodium japonicum*, Brongn. Ann. Sc. ser. 2, xii. 232. *T. sinense*, Forb. Pinet. Wob. 179. *Schubertia japonica*, Spach, Hist. Vég. Phan. xv. 352. *Taxodium Horsfieldii*, Knight. *Taxus nucifera*, hort. (not Thumb.). *Cupressus nucifera*, Denhardt in Heeb. Vindob. *Taxodium heterophyllum*, Brongn. Ann. Sc. ser. 1, xxx. 184.

Habitat.—China, in the neighbourhood of Canton, and along the banks of the river Whampoa. The limits of its distribution have not yet been ascertained.

Introduced into Europe early in the present century.

G. h. pendulus, Endl. Syn. Conif. 71. *Taxodium distichum pendulum* Carrière, Traité Génér. Conif. ed. 2, 182. *T. distichum sinense*, hort. *T. sinense pendulum*, Forb. Pinet. Wob. 180. *T. distichum sinense pendulum*, Loud. Encycl. of Trees, 1078. *T. sinense*, hort. Nois. Gord. Pinet. 309.

G. h. pendulus novus. *Taxodium distichum pendulum novum*, P. Smith.

All the forms of *Glyptostrobus* may be hardy, but it is not yet certainly determined, as the plants under observation are still young.

14. SEQUOIA.—Endl. Conif. 197; Torrey in Report of Bot. of Whipl. Expedit. 84; Carr. Conif. 163 and 209; Gord. Pinet. 303, and pl. auct. *Taxodii* sp. Lamb. Pinet. ed. 2, 107, t. 48; Winslow in Californ. Farm. for 1854. *Wellingtonia*, Lindl. in Gard. Chron. 1853, 823. *Washingtonia*, Winslow, l.c. *Schubertia* (?) sp. Spach, Hist. des Vég. Phaner. xi. 533; Parl. in D. C. Prodr. xvi. 2, 435; Bot. Mag. t. 4777 and 4778; Koch, Dendr. ii. 187; Henk. and Hockst. Syn. der Nadelh. 221; Ic. in Flore des Serres, t. 892 and 893; Desne. in Rev. Hort. ser. 4, iv. 10 and 11, fig. 12; Eichl. in Engl. and Prantl. Natürl. Pflf. ii. p. 85; Bull. Bot. Soc. France, i. 70; Gray in Proc. Am. Acad. iii. 94; Am. Journ. Sc. ser. 2, xvii. 440, xviii. 150; Torrey in Pacific R.R. Rep. iv. 140; Blake in Pacific R.R. Rep. v. 257, t. 13; Newberry in Pacific R.R. Rep. vi. 90; Cooper in Smithsonian Rep. 1858, 263; Wood, Bot. of Fl. 315; Bloomer in Proc. California Acad. iii. 397; Hoopes, Evergreens, 239; Bertrand in Ann. Sc. Nat. ser. 5, xx. 114; Vasey, Cat. Forest Trees, 36; Muir. in Proc. Am. Assoc. xxv. 242; Watson, Bot. California, ii. 117; Beissner, Nadelholzk. 156.

Flowers monœcious, solitary, and often terminal.

Cones small in the *Sequoia*, sub-globular, or obtusely oval, and ligneous. In the formerly called *Wellingtonia* they are twice as large.

Seeds from three to five under each scale, variously shaped, and winged.

Leaves evergreen, two-ranked, and flat in *Sequoia*. In the *Wellingtonia* the leaves are needle-shaped, spiral, and persistent, or scale-formed, and imbricated on adult trees, while the leaves of the *Sequoia* always acquire the form and expansion of a *Taxus*, and are two-ranked. The leaves on matured plants of *Wellingtonia* are also scale-like, closely imbricated, and attached to the branch by a broad base; and when, as happens in the more vigorous shoots, the leaves acquire unusual development, they still are sessile, with a triangular section, and no tendency whatever to form a flat leaf.

Lofty trees, found in California and North-west America.

The genus *Wellingtonia* is considered by most systematic botanists as untenable, it not being sufficiently distinct from Professor Endlicher's genus *Sequoia*; nevertheless the name has hitherto been almost universally adopted in garden literature.

S. gigantea, Torr. in Sillim. Journ. ser. 2, xviii. 150, ex Torr. and Whipl. Exposit. 84. *Wellingtonia gigantea*, Lindl. in Gard. Chron. 1853, s. 819 and 823. *Sequoia Wellingtonia*, Seem. in Bonpl. 1855, iii. 27. *Washingtonia californica*, Winsl. in Californ. Farm. 1854. *Taxodium Washingtonianum*, Winsl. l.c.

Habitat.—California, western slopes of the Sierra Nevada, from Placer County (Calaveras Grove), south to Deer Creek on the southern borders of Tulare County.

The largest tree of the American forest, 250-400 feet in height, with a trunk 20-40 feet in diameter; valleys and moist swales or hollows, between 4,000 and 6,000 feet elevation; growing in small, isolated groves, except towards its southern limits, where it is mixed with the Sugar Pine and red and white Firs, covering large tracts, often several hundred acres in extent.

Wood very light, soft, weak, brittle, rather coarse-grained, compact, remarkably durable in contact with the soil; bands of small summer cells thin, dark-coloured, conspicuous; medullary rays numerous, thin; colour bright clear red, turning much darker with exposure, the thin sapwood white; specific gravity, 0.2882; ash, 0.50; formerly manufactured into lumber, and locally used for fencing, shingles, construction, &c. (C. S. Sargent).

No known timber is so excessively light, soft, and brittle; its bark is tough, spongy, and stringy in texture, and seems to be largely charged with a crimson-coloured matter, exuding and hardening into a substance like gum. It is a form of tannin, and the *Wellingtonia* may thus supply a substitute for Oak bark (Lawson, "Pinetum Britannicum," *Sequoia Wellingtonia*, p. 13).

Sequoia gigantea, a writer in *Blackwood's Magazine* says, was first discovered in 1850 by a Mr. Dowd, who, when out hunt-

ing, was led by a herd of deer which he was following into the Big Tree Valley. He stopped as one enchanted, feeling like Gulliver when lost in the field of barley, such as he had never even dreamed of as existing in the world. He told his companions of his adventure on his return, but all laughed at his story as a barefaced attempt to impose on their credulity. It was with the greatest difficulty he succeeded in inducing some of them to accompany him to the spot, and verify his statements by actual inspection and measurement. The happy individual to whom common fame more generally ascribes the discovery is a Mr. J. M. Wooster, whose claims have rested on an inscription, "J. M. Wooster, June 1850," cut, *more Anglo*, into the bark of one of the trees—"Hercules," to wit. As this token of discovery has been mentioned in the very earliest notices of the tree, there is no doubt that the date of the inscription is genuine, and that it is not an *ex post facto* operation. It has been jestingly said that this is only a manuscript notice, and not publication, and, therefore, that Mr. Wooster is not entitled to the honour of the discovery, which must go, in right of priority, to the first person who published his discovery, Mr. Lobb. But Mr. Wooster himself disclaims it. Mr. Hutchins, in his "Scenes of Wonder and Curiosity in California," says: "Since writing the above we have made the acquaintance of Mr. Wooster, who disclaims all title to the discovery, although of the same party, and gives it to W. Whitehead, Esq., who, while tying his shoe, looked casually round him and saw the trees, June 1850." We confess we feel disposed to give the palm of discovery to Mr. Whitehead; the simplicity and probability of the discovery made on looking up from tying his shoe carry conviction to our mind. The incident of tying his shoe is the last that would occur to an inventor. A romancer would scarcely think of a party passing through the grove without noticing the enormous size and height of the trees; and yet what more natural than that people, not botanists, should have been passing through forests of all sizes, and not thinking about trees? It would only be when something made them pause that trees might strike them. It is, no doubt, exceedingly probable, and doubtless true, that Mr. Dowd discovered them in the same year, and possibly within a few days or weeks of Mr. Whitehead; but, in the absence of any data for determining which of them was first, we should certainly, for our part, place ourselves on the side of the man who discovered them while tying his shoe. The rumour of the discovery soon spread, and the grove was visited by many. Among these early visitors were two of our countrymen, who at least were the first to introduce the tree into Britain—Mr. John D. Matthew, son of Mr. Patrick Matthew, of Gourdiehill, near Errol, and Mr. Lobb, who was collecting for Mr. Veitch. The credit of introducing it is generally awarded to Mr. Lobb; and, so far as regards introducing it in commercial quantities, no doubt he was the

introducer. But *suum cuique tributo*. The first seeds received in this country were sent by Mr. Matthew, and the oldest plants are those which were raised from them. Mr. Lobb returned from California in December 1853, bringing his seeds with him, as appears from an article by Dr. Lindley in the *Gardeners' Chronicle* of 24th December in that year. "The other day," says he, "we received from Mr. Veitch branches and cones of a most remarkable coniferous tree, also Californian seeds, and a living specimen which had just been brought him by his excellent collector, Mr. William Lobb, who, we are happy to say, has returned loaded with fine things" ("Pinetum Britannicum").

The tree is one of the largest known on the face of the earth, perhaps the largest. It is not so thick as the *Adansonia* from West Africa, or as some of the *Leguminosæ* from South America, nor so tall as the gum trees of Australia, some of which reach 450 feet in height. Nor does its ally, the *Sequoia sempervirens*, come far short of it in size, although it stands a little in the background. Still, the *Wellingtonia* is perhaps the most striking of them all, combining more than any other both enormous height and thickness. Its average dimensions, when full-grown, are about 300 feet in height and 90 feet in girth at the base. The dimension of one of the fallen trees, whose top had been broken off, is estimated at 425 feet if the top had remained. Lord Richard Grosvenor (*Gardeners' Chronicle*, 7th January, 1860) speaks of one he had seen as being 450 feet high and 116 feet in circumference—a height greater than that of St. Peter's at Rome, and little less than the Pyramids. Mercantile men may bring home to their minds the enormous size of these trees in another way, viz., by calculating the quantity of wood in a tree, and its price at a penny per foot of inch deal, which gives the astounding result of £6,250 as the value of a single tree. Although this is a good mode of showing the enormous quantity of timber in one of these trees, it would not do for practical calculations of its value.

Sequoia gigantea does not become fully developed in all parts of Denmark. The finest plants are to be seen in the eastern part of the country. In 1883 some fine trees, whose age was about 25 years, were measured in Gierslev Park; the height of the biggest tree then was 40 feet, and the circumference of the stem, breast high, was a little more than 4½ feet. I have since that time observed the trees, which are continuing a fine growth and produce very well-developed cones.

In other gardens and parks trees almost as tall are to be seen, but often the lower branches are somewhat spoilt.

In Norway *Sequoia gigantea* has been tried in several places along the coast between Christiania and Molde (62° 44'). In the Botanic Gardens at Christiania Professor Schübeler planted a sapling 2 feet high out of doors. It lived for several years, but each summer's

growth was generally more or less killed by frost in the winter. There is reason to believe that this species will not thrive there.

At Balestrand great farm gardens (61° 15') there was planted in the spring of 1876 a *Wellingtonia* of about 1 foot high. In the hard winter of 1880-81 the top shoot was killed, but afterwards a new one sprang up. In September 1885 the tree had a height of 17 feet 10 inches.

In Southern Sweden the *Wellingtonia* seems to do well, but it is perhaps not to be found farther north than Gothenburg (57° 42').

S. sempervirens, Endl. Conif. 178. *Taxodium sempervirens*, Lamb. Pin. ed. 2, 120, t. 64. *T. nutkaense*, Lamb. Herb. *Schubertia sempervirens*, Spach, Hist. des Vég. Phan. xi. 353. *Sequoia gigantea*, Endl. Conif. 198.

Habitat.—California, from the northern boundary of the State, south through the coast ranges to Veer's Creek, near the southern border of Monterey County.

A large tree of great economic value, 200-300 feet in height, with a trunk 8-23 feet in diameter, sending up from the stump when cut many vigorous shoots; sides of cañons and gulches in low, wet situations, borders of streams, &c., not appearing on dry hillsides; generally confined to the western slopes of the coast ranges, and nowhere extending far from the coast; most generally multiplied and reaching its greatest average density north of Cape Mendocino (C. S. Sargent, "Forest Trees of North America").

The Redwood was discovered by Mr. Archibald Menzies in 1795, from whose specimens Mr. Lambert figured and described it in his great work, "The Genus Pinus," under the name of *Taxodium sempervirens*. Nothing more was heard of it till David Douglas visited California in 1831, but he, from some cause not now known, failed to introduce it into England. Dr. Coulter, who travelled in California in 1836, was the next botanist to make mention of it, but no seeds were received from him. Ten years later Hartweg, when collecting for the Royal Horticultural Society, succeeded in sending to England the first consignment of cones and seeds to which any authentic date can be assigned, but Mr. Gordon affirms that it was introduced into Europe by the Russians in 1843, or three years earlier than the receipt of Hartweg's consignment.

Douglas makes the following remark, in a letter published in Hooker's "Companion to the Botanical Magazine," ii. 150: "But the great beauty of Californian vegetation is a species of *Taxodium*, which gives the mountains a most peculiar, I was almost going to say awful, appearance, something which plainly tells us we are not in Europe. I have repeatedly measured specimens of this tree 270 feet long, and 52 feet round at 5 feet above the ground. Some few I saw upwards of 300 feet high, but none in which the thickness was greater than those I have instanced." This passage led to the belief that the *Wellingtonia*

was first seen by Douglas in his Californian explorations; but this is now known to be a mistake. Mr. William Lobb has shown, from the route followed by Douglas, which is perfectly well known, that he never came within 120 miles of any of the habitats of this tree. What he saw was *Sequoia sempervirens*, as may be otherwise inferred from the terms in which he speaks of it ("Pinetum Britannicum").

Owing to the accessibility of the Redwood forests, due to their proximity to the coast, and to their being traversed by innumerable streams, the consumption of Redwood timber is proceeding at a rate that would almost exceed belief were it not attested by reliable statistical facts. Sawmills and logging camps are established along the coast, where the immense trunks are reduced to useful timber with a prodigious waste of wood. More destructive still are the operations of the sheep farmer, who fires the herbage to improve the grazing, and whose flocks of tens of thousands of sheep devour every green thing more effectively than the locust.

During the last quarter of a century the Anglo-Saxon has been ruthlessly carrying fire and the saw into the forests of California, destroying what he could not use, and sparing neither young nor old, and before a century is out the two Sequoias may be known only as herbarium specimens and garden ornaments; indeed, with regard to the "Big Trees," the noblest of the noble coniferous trees, the present generation, which has actually witnessed its discovery, may live to say of it that "The place thereof will know it no more" (Sir J. D. Hooker, "Address to the Members of the Royal Institution," April 1878).

Sequoia sempervirens is still somewhat rare in the gardens of Denmark. A plant measured in 1882 at Fuglsang was reported to have attained a height of 10 or 11 feet. At the gardens of the brewery, Carlsberg, near Copenhagen, I have seen a somewhat smaller plant which produced cones. It is covered with Spruce branches every winter. The young plants of the Redwood seen in other gardens often suffer from frost on the young growth. Near the coast the plant seems to prosper best.

S. s. adpressa, Carr. Tr. Gén. Conif. ed. 2, 211. *S. s. albo spicata* or *spicata*, hort. *S. pyramidata*, hort. *Taxodium sempervirens albo spica*, hort. This variety seems to be more tender than the type.

15. ATHROTAXIS.—Don in Linn. Trans. xviii. 171; Hook. Icon. t. 559, 573, 574; Hook. fil. in Lond. Journ. of Bot. iv. 148; Endl. Conif. 193; Carr. Tr. Gén. Conif. 158; Gord. Pin. 29; Henk. and Hochst. Nadelh. 219. *Cunninghamia* sp. Zucc. in Sieb. Fl. Jap. ii. 9; Brongn. Diet. Univ. d'Hist. Nat. iv. 464; Benth. Fl. Austr. vi. 241; Eichl. in Engl. and Prantl. Natürl. Pfl. ii. s. 89.

Flowers monœcious, solitary, terminal, and separate; sometimes the different sexes are found entirely occupying distinct plants.

Cones small, ovoid or globular, and woody.

Scales oval, entire, destitute of bracts, and imbricated.

Seeds from three to five or six under each scale.

Cotyledons two.

Leaves without petioles, scale-formed, and either closely adpressed to the branchlets or open and incurved.

Name derived from *arthron*, a joint, and *taxis*, arrangement, the shoots having the appearance of being jointed.

All small trees, natives of Tasmania. Some of them have fruited in the South of England. With protection it seems possible to winter some out of doors in Denmark.

A. cupressoides, Don. *Cunninghamia cupressoides*, Zucc. Fl. Jap. ii. 9. *A. imbricata*, Maule ex Gord. Pin. suppl. 16. *A. cupressoides*, Don in Linn. Trans. xviii. 173, t. 13, f. 2; Hook. Ic. t. 559, and Fl. of Tasm. i. 354; Lindl. and Gord. Journ. Hort. Soc. v. 222; Endl. Syn. Conif. 196; Carr. Tr. Gén. Conif. 161; Gord. Pinet. 30. *A. imbricata*, hort. aliq.

Habitat.—Tasmania, near the sea of Saint Claire and the Pine River.

Wintered indoors.

A. laxifolia, Hooker in Lond. Journ. of Bot. iv. 149, and Ic. t. 573; Lindl. and Gord. Journ. Hort. Soc. v. 222; Endl. Syn. Conif. 196; Carr. Tr. Gén. Conif. 162; Gord. Pinet. 30. *A. Doniana*, Maule ex Gord. l.c.

Habitat.—Tasmania, near the cataracts of Meandra.

Introduced into Europe in 1858.

Wintered indoors.

A. selaginoides, Don. *Cunninghamia selaginoides*, Zucc. Fl. Jap. ii. 9 (in note). *A. selaginoides*, Don in Linn. Trans. xviii. 171, t. 14; Hook. Ic. t. 574, and Fl. of Tasm. i. 353; Endl. Syn. Conif. 194; Carr. Tr. Gén. Conif. 159 (excl. syn. Lindl. and Gord., and Endl.); Gord. Pinet. 31. *A. alpina*, hort. ex Gord. l.c. *A. imbricata*, hort.

Habitat.—Tasmania, near the cataracts of Meandra.

Introduced into Europe about 1847.

Wintered indoors.

TRIBE III.—*TAXEÆ*.

16. TAXUS.—Tourn. Inst. 362; Linn. Gen. n. 1135; Juss. Gen. n. 412; Rich. Conif. 131, t. 2; Spach, Hist. des Vég. Phan. xi. 290; Endl. Gen. Pl. 1799, and Conif. 242; Carr. Tr. Gén. Conif. 516 and 729; Gord. Pinet. 210; Henk. and Hochst. Nadelh. 352; Parl. Fl. Ital. iv. 94. *Verataxus*, Nelson, Pin. 168; Parl. in D. C. Prodr. xvi. 2, 499; Zucc. in Abhandl. Bayer. Akad. München. iii. 892, t. 5; Nees, Gen. Pl. Germ. Monoch. n. 14; Rehb. Ic. Fl.

Germ. t. 538 ; Wall. Tent. Fl. Nep. t. 44 ; Sieb. and Zucc. Fl. Jap. t. 128 ; Nutt. N. Am. Sylv. t. 108 ; Eichl. in Engl. and Prantl. Natürl. Pflf. ii. p. 112 ; Willkomm, Forstfl. Fl. p. 270 ; Loud. Arbor. et Frut. Brit. iv. 2066 ; Veitch, Man. Conif. 291 ; Beissner, Nadelholz. 166.

Flowers dioecious, sometimes monoecious, axillary.

Fruit solitary, and one-seeded.

Disc a fleshy open cup, and viscid.

Seeds nut-like, with a bony shell, free, and exposed on the upper part.

Leaves linear, decurrent, and alternate.

Cotyledons two, short.

Name derived either from *taxis*, arrangement, from the leaves being placed on the branchlets like the teeth of a comb, or from *toxicum*, poison, the common Yew being poisonous, or from *taxum*, a bow, the wood being much used for that purpose.

The English name Yew is said to come from the Celtic *yew*, green.

All evergreen trees, or bushes, found in the temperate and cool temperate parts of Europe, Asia, and America.

T. brevifolia, Nutt. Sylv. iii. 86, t. 108. *T. baccata*, Hook. Fl. Bor. Amer. ii. 167. *T. Lindleyana*, Murr. in Edinb. New Phil. Journ. 1855, 294. *T. Boursierii*, Carr. Rev. Hort. 1854, 228, and Conif. ed. 2, 739. *T. occidentalis*, Nutt. l.c.

Habitat.—Queen Charlotte Island and the valley of the Skeena River ; south through the coast ranges of British Columbia, through Western, and the mountain ranges of Eastern, Washington Territory and Oregon to the western slopes of the Rocky Mountains of Northern Montana (Canby and Sargent) ; through the Californian coast ranges to the Bay of Monterey, and along the western slopes of the Sierra Nevadas to about latitude 37° N.

A tree 60-80 feet in height, with a trunk 1-2 feet in diameter, or towards its eastern limits in Idaho and Montana much smaller, often reduced to a low shrub ; rare ; low, rich woods and borders of streams, reaching its greatest development in Western Oregon, Washington Territory, and British Columbia (C. S. Sargent).

T. baccata, L. Spec. Pl. 1472. 'Ομῖλος, Theophr. Hist. Plant. iii. 4, 6, 7. Σπύλαξ ἡ τάξος, Galen. Simpl. 8 ; Diosc. iv. 80. *Taxus*, Plin. Hist. Nat. xvi. 20, 23 ; Matthiöl. Valgris. 444 ; Bauhin, Hist. i. 241 ; English Botany, tab. 746 ; Schkuhr, tab. 339 ; Rich. Conif. 19, t. 2 ; Loud. Arbor. Brit. iv. 2066, f. 1981-91, and Encycl. of Trees, 939, f. 1751-52 ; D. C. Fl. Fr. iii. 279 ; Desf. Hist. Arbr. ii. 554 ; Hook. Fl. Bor. Amer. ii. 167 ; Spach, Hist. Nat. Vég. Phan. xi. 292, and Atl. Pl. 132, f. 2 ; Endl. Syn. Conif. 242 ; Lindl. and Gord. Journ. Hort. Soc. v. 227 ; Knight, Syn. Conif. 52 ; P. D. Dict. Univ. d'Hist. Nat. vii. 20 ; Carr. Tr. Gén. des Conif. 517 ; Gord.

Pinet. 311. *T. nuciifera*, Wall. Tent. Fl. Nep. 44, t. 57 (excl. syn.).
T. virgata, Wall. Pl. Exsicc. *T. nepalensis*, Jacq. Pl. Exsicc.
T. Wallichiana, Zucc. in Abhandl. d. Math. Phys. Kl. d. Bayer Akad.
 iii. 803, t. 5.

The Yew being almost always raised from seed, the male and female plants may be supposed to be nearly equally distributed, both in natural woods and in artificial plantations. According to Miller and Lamarck, both sexes are sometimes found on the same tree. "As far as we have been able to observe," says White of Selborne, "the male tree becomes much larger than the female one" (Nat. Hist. of Selb. ed. 1789).

Varennes de Feuilles states that the wood, before it has been seasoned, when cut into veneers, and immersed some months in pond water, will take a purple-violet colour, probably owing to the presence of alkali in the water. According to this author, the wood of the Yew weighs, when green, 80 lbs. 9 oz. per cubic foot, and when dry 61 lbs. 7 oz. It requires a longer time to become perfectly dry than any other wood whatever; and it shrinks so little in drying as not to lose above $\frac{1}{8}$ th part of its bulk. The fineness of its grain is owing to the thinness of its annual layers, 280 of these being sometimes found in a piece not more than 20 inches in diameter. It is universally allowed to be the finest European wood for cabinet-making purposes. Tables made of Yew, when the grain is fine, according to Gilpin, are more beautiful than tables of mahogany, and the colour of its root is said to vie with the ancient citron. It is generally employed in the form of veneers, and for inlaid work; it is also used by the turner, and made into vases, snuff-boxes, musical instruments, and a great variety of similar articles. Both the root and trunk furnish, at their ramifications, pieces of wood beautifully veined and marbled, which are highly prized. The sapwood, though of as pure a white as the wood of the Holly, is easily dyed a jet black, when it has the appearance of ebony.

T. baccata has in several Danish gardens attained a height of over 30 feet.

Habitat.—The Yew is indigenous to most parts of Europe, from lat. 58° N. to the Mediterranean Sea, and also to the east and west of Asia; and on the supposition that *T. canadensis* is only a variety of *T. baccata*, which we believe to be the case, the common Yew is also a native of North America, in Maryland, Canada, and other places. In a wild state it is confined to shady places, such as the north side of steep hills, or among tall deciduous trees, and is always found on a clayey, loamy, or calcareous soil, which is naturally moist. It sometimes grows in the clefts of dry rocks, but never on sandy plains; and hence it is wanting in the Russian Empire, except on the mountains of the Crimea and in the Caucasus. It is found in every part of Britain, and also in Ireland—on limestone cliffs and in mountainous woods

in the South of England, and on schistous, basaltic, and other rocks in the North of England; and in Scotland it is particularly abundant on the north side of the mountains near Loch Lomond. In Ireland it grows in the crevices of rocks, at an elevation of 1,200 feet, but at that height it assumes the appearance of a low shrub. According to Templeton, it is rarely, if ever, found there in a state which can be considered truly wild. The Yew is rather a solitary than a social tree, being generally found either alone or with trees of a different species. In England, and also, as Pallas tells us, in the Caucasus, it grows under the shade of the Beech, which few other evergreens will do.

It grows wild in West Norway up to lat. $62\frac{1}{2}^{\circ}$ N. In East Norway it goes to $60^{\circ} 28'$. In Sweden it thrives near the coast, and is growing wild up to 61° . In Finland it is not growing wild. On the Aaland Island it only grows as a small shrub. In Denmark the only place it is growing wild is at Munkehjerg, the beautifully situated hotel near the town of Veile, in Jutland. These fine plants are seen growing together with many Ilex, &c. Formerly the Yew was much more widely spread in Denmark, but owing to the value of the wood the wild plants have been destroyed in most parts of the country.

Professor F. C. Schübeler says in his "Viridarium," 1886, that the only variety of those he tried at Christiania that flourished was *T. baccata penulula*. Several times he planted *T. baccata fastigiata* or *hibernica*; sometimes it grew tolerably well, but ordinarily it suffered to such a degree that it could not be used for decoration; but at the marine establishment at Horten, at the Christianiafjord ($59^{\circ} 51'$), this form for many years did very well, and has reached a height of 13 to 14 feet.

The Yew is also found in Algeria, on Mount Taurus in Cilicia, in Greece, in Armenia, and, according to Parlatore, as far eastwards as the River Amour. On the Himalayas it occurs at a height of 10,000 feet, and spreads eastwards from Kashmir to Assam and the Khasya Hills; also in Japan and the Philippine Islands.

In a wild state the Yew affords food to birds by its berries, and an excellent shelter to them during severe weather, and at night by its dense evergreen foliage, but no insects live on it; and the male plant at least is credited with being poisonous.

It is admirably adapted for underwood, because, like the Holly and the Box, it thrives under the shade and drip of other trees. When planted in masses by itself, the trees are drawn up with straight trunks, like Pines and Firs, and in good loamy soil, on a cool bottom, plantations of Yews, treated in this manner, must be highly valuable.

T. b. adpressa, Carr. Man. des Pl. iv. 380, and Conif. 731. *T. adpressa*, Gord. Pinet. 310. *T. sinensis tardiva*, Knight, Syn. Conif. 52. *T. brevifolia*, hort. *T. parvifolia*, Wender, Conif. 42. *T. baccata microphylla*, Jacq. *T. cuspidata*, Sieb. and Zucc. Koch,

Dendr. ii. 96. *Cephalotaxus tardiva*, Sieb. Mss.; Endl. Conif. 239. *C. adpressa*, hort. *C. brevifolia*, hort.

This variety is perhaps, in Norway, only to be found at Laurvik ($59^{\circ} 3'$), where it has done well for several years. In Sweden it thrives well at Lund in Skaane ($55^{\circ} 42'$), but poorly enough at Stockholm ($59^{\circ} 20'$). We have very finely developed shrubs of it in different parts of Denmark.

T. b. adpressa stricta, hort. *T. b. verticillata*, hort. *T. adpressa stricta*, hort. *T. a. erecta*, hort. *T. a. fastigiata*, hort.

T. b. Dovastonii, Carr. Rev. Hort. 1861, 175. *T. pendula*, hort. *T. Dovastonii*, hort. *T. umbraculifera*, hort. *T. cuspidata*, Sieb. and Zucc., Koch, Dendr. ii. 97. *Cephalotaxus umbraculifera*, Sieb. (in Endl. Syn. Conif. 239).

The Westfelton Yew stands in the grounds of T. F. M. Dovaston, Esq., at Westfelton, near Shrewsbury, and the following account has been sent to us by that gentleman: "About sixty years ago, my father, John Dovaston, a man without education, but of unwearied industry and ingenuity, had, with his own hands, sunk a well, and constructed and placed a pump in it; and the soil being light and sandy, it continually fell in. He secured it with wooden boards; but, foreseeing their speedy decay, he planted near to the well a Yew tree which he bought of a cobbler for sixpence, rightly judging that the fibrous and matting tendency of the Yew roots would hold up the soil. They did so, and, independently of its utility, the Yew grew into a tree of the most extraordinary and striking beauty, spreading horizontally all round to the diameter of (now, 1836) 56 feet, with a single aspiring leader to a great height, each branch in every direction dangling in tressy verdure downwards; the lower ones to the very ground, pendulous and playful as the most graceful Birch or Weeping Willow, and visibly obedient to the feeblest breath of summer air. Its foliage is admirably adapted for retaining the dewdrops, and, in consequence, it makes a splendid appearance at sunrise. Though a male tree, it has one entire branch self-productive and exuberantly profuse in female berries, full, red, rich, and luscious, from which I have raised several plants, in the hope that they may inherit some of the beauty of their parent" (Loud. Arbor. et Frut. Brit.).

T. b. ericoides, hort. (the Heath-like Yew). *T. ericoides*, hort. *T. empetrifolia*, hort. *T. microphylla*, hort. *T. baccata microphylla*, hort.

A small, slender, slow-growing variety, with very small dark green foliage, and rather short, erect, slender twigs, very distinct in appearance, and only from one to two feet high.

T. b. fastigiata, Loud. Encycl. of Trees, 939, f. 1751. *T. b. hibernica*, hort. *T. fastigiata*, Lindl. and Gord. Journ. Hort. Soc. v. 227. *T. hibernica*, Hook. Mack. Fl. Hybern. 260. *T. pyramidalis*, hort. aliq.

The Irish Yew has, in some Danish gardens, attained the height of about 20 feet.

A very distinct variety, readily distinguished from the species by its upright mode of growth and deep green leaves, which are not distichously arranged like those of the common Yew, but are scattered around the branchlets. It is the Irish Yew of gardens.

T. b. fructo luteo. This variety appears to have been first discovered by Mr. Whitlaw of Dublin, about 1817, or before, growing on the demesne of the Bishop of Kildare, near Glasnevin; but it appears to have been neglected till 1833, when Miss Blackwood discovered a tree of it in Clontarf churchyard, near Dublin. Mr. Mackay, on looking for this tree in 1837, found no tree in the churchyard, but several in the grounds of Clontarf Castle, and one (a large one) with its branches overhanging the churchyard wall. The tree does not differ, either in its shape or foliage, from the common Yew; but, when covered with its berries, it forms a very beautiful object, especially when contrasted with Yew trees covered with berries of the usual coral red colour.

T. canadensis, Willd. Sp. Pl. iv. 856. *T. baccata minor*, Mich. Fl. Amer. ii. 245. *T. baccata*, Hook. Fl. Bor. Amer. ii. 167. *T. procumbens*, Lodd. Cat. 1836, 67.

Habitat.—Parts of Eastern Canada (to 54° N.) and the North-eastern States, especially on the Alleghanies to Virginia.

Introduced into Europe about 1800. It has for the last twenty years done well at Christiania.

17. CEPHALOTAXUS.—Sieb. and Zucc. in Endl. Gen. Pl. suppl. ii. 27; Endl. Conif. 237; Carr. Conif. 507; Gord. Pinet. 44; Henk. and Hochst. Nadelh. 361; Nelson Pin. 166. *Taxi* sp. Thunb. Fl. Jap. 275; Parl. in D. C. Prodr. xvi. 2, 502; Forb. Pinet. Wob. t. 66 (*Taxus*); Bot. Mag. t. 4499; Sieb. and Zucc. in Endl. Gen. Pl. suppl. ii. and Syn. Conif. 237; Carr. Conif. 715; Gord. Pinet. 44; C. Koch, Dendr. ii. 102; Henk. and Hochst. Syn. der. Nadelh. 361; Eichl. in Engl. and Prantl. Natürlich. Pfl. ii. 109; Beissner, Nadelholzk. 178.

Flowers dioecious, pedunculate, and in globular heads.

Fruit drupaceous, or, like the common plum, fleshy outside, and two or three in a head.

Seeds solitary, nut-like, with a bony or woody shell, and enclosed in the fleshy cup; about the size of a damson, and ripening the second year.

Leaves one-nerved, linear, alternate, and in two rows.

Cotyledons two, short.

Name derived from *kephale*, a head, and *taxis*, arrangement, flowers and fruit growing in close globular heads.

All evergreen shrubs; found in China and Japan.

C. drupacea, Sieb. and Zucc. Fl. Jap. Fam. Nat. ii. 108,

and Fl. Jap. ii. t. 130, 131. *Taxus baccata*, Thunb. Fl. Jap. 275 (excl. syn.). *C. Fortunei fœmina*, hort. aliq. *C. coriacea*, Knight, Syn. Conif. 51. *Taxus coriacea*, Knight, l.c. *T. japonica*, Hook. ex Gord. Pinet. 45, suppl. 21.

Habitat.—In Japan, at a height of 1,625–3,250 feet, it grows more like a shrub than a tree; it is also to be found in forests of deciduous trees on the Kamagana Mountains, on the Island of Tsusima, near Nagasaki, where it is also cultivated, and on Nippon, near Yokoska and Kumagava.

It was discovered by Mr. Fortune in North China in 1848.

Seems to be hardy.

C. Fortunei, Hook. Bot. Mag. t. 4499. *C. Fortunei mas*, hort. Introduced from North China by Mr. Fortune in 1849.

C. Fortunei has in some Danish gardens attained a height of about 5 feet.

C. gracilis. I have been able to examine only one plant, which seems to be hardy.

C. pedunculata, Sieb. and Zucc. Fl. Jap. Fam. Nat. ii. 108, and Fl. Jap. ii. t. 133. *Taxus Harringtonia*, Forb. ex Pinet. Wob. 217, t. 63. *T. Iwakaja*, Knight, Conif. 51.

Habitat.—In Japan, on the mountains of Kiusiu, on Nippon; and also in China, in Chusan.

It was introduced from Japan in 1837 under the name of *Taxus Harringtoniana*, by which name it is often known in collections.

Has proved hardy in several places in Denmark.

C. p. fastigiata, Carr. Rev. Hort. 1863, 439, fig. 36, and Conif. ed. 2, 717. *Podocarpus koraiana*, Sieb. in Soc. d'Hort. des Pay-Bas, 1844, 35. *C. Burgerii*, Miq. Ann. Mus. Lug. Batav. iii. 169; Prolusio Fl. Jap. 333. *C. koraiana*, hort. *Taxus japonica*, Lodd. ex Gord. Pinet. 275. *Podocarpus coriacea*, hort. *P. Sciadopitys*, hort.

Introduced from Japan in 1861.

Has proved hardy in many gardens.

This plant is better known among horticulturists as *Podocarpus koraiana* or *Taxus japonica*. That it is no other than a variety of *Cephalotaxus pedunculata* M. Carrière has clearly demonstrated. He remarks that “the doubts I expressed in my former edition relative to the specific value of *Podocarpus koraiana* are realised, and, as I suspected, instead of a *Podocarpus* it is an accidental fastigiata form of *C. pedunculata*. I have seen a strong plant of this variety which at 2 feet from the ground had developed lateral branches with distichous foliage, and which at that point had formed a verticil like a projecting stage, while the parts both above and below were quite upright.”

18. TORREYA.—Arnott in Ann. of Natur. Hist. i. 126; Hook. Icon. iii. t. 232, 233; Endl. Gen. Pl. suppl. ii. 27, and Conif. 240; Carr. Conif. 511 and 723; Gord. Pinet. 326. *Podocarpus*

sp. Pers. Syn. ii. 633. *Caryotaxus*, Zucc. Msc. ; Henk. and Hochst. Nadelh. 365. *Festataxus*, Nelson, Pinac. 167 ; Engelm. Bot. of Calif. ii. 120 ; Lamb. Pinet. t. 32, éd. min. t. 45-47 (*Pinus*) ; Sieb. and Zucc. Fl. Jap. t. 106 (*Abies*) ; Wall. Pl. As. Rar. t. 247 (*Pinus*) ; Nutt. N. Amer. Sylv. t. 116 ; Newberry, Bot. Williams Exp. t. 7 ; C. Koch, Dendr. ii. 248 (subgenus) ; Henk. and Hochst. Nadelh. 148 (Sekt. i. von *Abies*) ; Coulter's Bot. Gaz. vi. 223 ; Chapman, Fl. S. States, suppl. 650 ; Maxim. Mém. Biol. vi. 373 ; Franch. and Savat. Enum. Pl. Jap. ; Eichler in Engl. and Prantl. Natürl. Pflf. iii. 80 ; Wilkomm, Forstl. Flora, 102 ; Parl. in D. C. Prodr. xvi. 2, 504 ; Nutt. N. Americ. Sylv. t. 109 ; Newb. Pl. Williams Exped. 62, *cum ic.* ; Koch, Dendr. ii. 97 ; Eichl. in Engl. and Prantl. Natürl. Pflf. ii. 111.

As the name "*Torreya*" already exists in *Nyctaginia* (Spreng.), and in *Cyperaceæ* (Raf.), it might be better to give the name "*Caryotaxus*" to this genus.

Flowers dioecious. Males solitary ; females in twos or threes, erect, and all axillary.

Fruit one-seeded, drupaceous, resembling a nutmeg both externally and internally ; fleshy on the outside, like the common plum.

Seeds solitary in each fruit, with the albumen ruminated like the inside of the common nutmeg, and covered with a hard bony shell.

Leaves linear or lanceolate, decurrent at the base, and either opposite or alternate, large, of a disagreeable odour.

Cotyledons two.

Named in compliment to Dr. Torrey, the celebrated American botanist, and one of the authors of the "North American Flora."

All small evergreen trees, found either in North America, China, or Japan, and emitting a strong disagreeable smell from all parts when bruised.

T. californica, Torr. in New York Journ. Pharm. iii. 49, and Whipple's Rep. 14. *T. Myristica*, Hook. fil. in Bot. Mag. t. 4780 (1854). *Caryotaxus Myristica*, Henk. and Hochst. Nadelh. 368.

Habitat.—On the Sierra Nevada, in California, up to an elevation of 5,000 feet. Generally also in the vicinity of rivers or moist ground.

Introduced into Europe in 1851 by W. Lobb.

Only one plant has been observed, and nothing can be said yet as to its hardiness.

T. grandis, Fort. in Gord. Pinet. 326. *Caryotaxus grandis*, Henk. and Hochst. Nadelh. 367.

It was introduced from Northern China (Che-Kiang) by Mr. Fortune in 1847. It is scarcely distinguishable from the Japanese *Torreya nucifera*.

Only one plant has been observed, and nothing can yet be said about its hardiness ; it has kept well a couple of winters covered with green branches.

P. nucifera, Sieb. and Zucc. Fl. Jap. ii. t. 129. *Taxus nucifera*, Kämpf. Amoen. Exot. 814, 815, *cum ic.* *Podocarpus nucifera*, Pers. Syn. ii. 633. *Caryotaxus nucifera*, Zucc. Mss. ; Henk. and Hochst. Nadelh. 366. *Podocarpus coreana*, Van Houtte, Catal. *P. coreana*, hort.

It is found in Japan sparingly on the mountains, and also on the west coast of Nippon and Sikok, at an elevation of from 1,625 3,250 feet. It was introduced into European gardens about 1818.

Wintered in a cold frame in Denmark.

19. GINKGO.—Kämpf. Amoen. Exot. 811, 813 ; Linn. Mant. ii. 313, 314. *Salisburia*, Smith in Linn. Trans. iii. 330 ; Rich. Conif. 133, t. 3 ; Endl. Gen. Pl. n. 1803, and Conif. 236 ; Carr. Conif. 503 ; Gord. Pin. 298 ; Henk. and Hochst. Nadelh. 373. *Pterophyllum*, Nelson, Pin. ; Parl. in D. C. Prodr. xvi. 2, 498, 506 ; Van Tiegh. in Ann. Sc. Nat. ser. 5, x. 276 ; Wats. Dendr. Brit. t. 168 (*Salisburia*) ; C. Koch, Dendr. ii. 107 ; Eichl. in Engl. and Prantl. Natürl. Pfl. ii. 108 ; Beissner, Nadelholzk. 189.

Flowers dioecious ; the males in spikes, axillary, and without pedicels ; the female in terminal clusters, on long pedicels.

Fruit drupaceous, or covered with a fleshy pulp, and smooth externally, mostly single from abortion, and enclosed at the base in a small fleshy cup.

Seeds solitary in each fruit, and covered with a smooth, hard, bony shell.

Leaves fan-shaped, on long petioles, lobed, jagged on the outer margins, and covered on both sides with minute radiating nerves.

Cotyledons two.

The name *Salisburia*, by which the Ginkgo is often known, was given in compliment to R. A. Salisbury, F.R.S., an eminent English botanist.

A large deciduous tree, native of China and Japan.

G. biloba, Linn. Mant. ii. 313, 314. *Salisburia adiantifolia*, Salisb. in Linn. Trans. iii. 330.

The Japanese names for this tree are “Ginn” (deciduous tree), and “Fusi-kin-go” (buds crowned with leaves in summer). The Chinese call it “Ginkgo” (full of leafless buds in winter), in addition to “Ginn,” “Quachow,” and “Gin-ki-go” (a tree without leaves in winter).

Habitat.—Northern China. It is frequently met with in Japan, where it was most probably introduced.

Introduced into England about 1754. It had been made known to Europeans sixty years previously by Kämpfer (Veitch).

G. b. macrophylla, hort. *Salisburia adiantifolia laciniata*, Carrière. *Salisburia macrophylla*, Regnier. *G. biloba laciniata*, hort.

This variety differs from the species in its leaves being very much

larger, some of them measuring 10 inches in circumference, and divided into two, three, or five lobes—the principal lobes being again subdivided, undulated, and irregularly laciniated, or dentated on the edges ; a very fine variety of French origin.

The *Salisburia*, or Ginkgo tree, is generally considered by botanists to be a native of the Island of Nippon and other parts of Japan, and also of China ; but M. Siebold, who resided seven years in Japan, and published a flora of that country, states that the inhabitants of Japan consider the tree as not truly indigenous to their country, but to have been brought to them from China, though at a very remote period ; and Bunge, who accompanied the mission from Russia to Peking, states that he saw near a pagoda an immense Ginkgo tree, with a trunk nearly 40 feet in circumference, of prodigious height and still in the vigour of vegetation (Bull. de la Soc. d'Ag. du Départ. de l'Hérault, 1833). It was first discovered by Kämpfer in Japan in 1690, and an account of it was published by that author in his "*Amœnitates Exoticæ*" in 1712. It is uncertain when this tree was introduced into Europe. If the estimate made by Professor Kops of Utrecht as to the age of the *Salisburia* growing in the Botanic Garden there be at all near the truth, it must have been first introduced into Holland between 1727 and 1737, and, from the connection of the Dutch with Japan at that time, we think this highly probable. It is certain that it was not introduced into England till 1754, or a year or two previous, because Ellis, writing to Linnæus in that year, mentions that Gordon had plants of it. Gordon sent a plant of it to Linnæus in 1771, who, in his "*Mantissa*," published in that year, noticed it, for the first time, under the name of *Ginkgo biloba*, which was altered by Smith in 1796 to *Salisburia adiantifolia*. This alteration, stated by Smith to be made on account of the generic name being "equally uncouth and barbarous," was very properly objected to at the time, and has since been protested against by M. de Candolle, on the principle of checking the introduction of a multiplicity of names.

The manner in which this tree was introduced into the gardens of Paris is curious, and was thus related by M. André Thouin, when delivering his annual *Cours d'Agriculture Pratique* in the *Jardin des Plantes*: In 1780 a Parisian amateur named Pétigny made a voyage to London in order to see the principal gardens, and among the number of those he visited was that of a nurseryman who possessed five young plants of *Ginkgo biloba*, which was still rare in England, and which the gardener pretended that he then alone possessed. These five plants were raised from nuts that he had received from Japan, and he set a high price on them. However, after an abundant *déjeuner*, and plenty of wine, he sold to M. Pétigny these young trees of Ginkgo, all growing in the same pot, for 25 guineas, which the Parisian amateur paid immediately, and lost no time in taking

away his valuable acquisition. Next morning, the effects of the wine being dissipated, the English gardener sought out his customer, and offered his 25 guineas for one plant of the five he had sold the day before. This, however, was refused by M. Pétigny, who carried the plants to France; and, as each of the five had cost him about 120 francs, or 40 crowns (*quarante écus*), this was the origin of the name applied to this tree in France, of *arbre aux quarante écus*, and not because it was originally sold for 120 francs a plant. Almost all the Ginkgo trees in France have been propagated from these five, imported from England by M. Pétigny.

The wood of the Ginkgo is said by Kæmpfer to be light, soft, and weak; but Loiseleur Deslongchamps describes it as of a yellowish white, veined, with a fine close grain, and moderately hard. It is easy to work, receives a fine polish, and resembles in its general appearance citron wood. It is, he says, much more solid and strong than the ordinary white woods of Europe; and though the tree is closely allied to the Coniferae, it has nothing resinous in its nature. In China and Japan the Ginkgo appears to be grown chiefly for its fruit, the nuts of which, as Dr. Abel observes, are very generally exposed for sale in the markets of China, though he was not able to ascertain whether they were used as food or as medicine. In Japan, according to Kæmpfer, they are never omitted at entertainments, entering into the composition of several dishes, after having been freed from their acidity by roasting or boiling. They are reputed, he says, to be useful in digestion and in dispelling flatulence. Thunberg says that even the fleshy part of the fruit is eaten in Japan, though insipid or bitterish; and that, if slightly roasted, skin and all, it is not unpalatable. Some of the fruits which ripened in the Botanic Garden of Montpellier were tasted by M. Delille and MM. Bonafous of Turin, who found their flavour very like that of newly roasted maize. M. Delille says that after roasting the nuts he found nothing in the kernels but a farinaceous matter, without the least appearance of oil, notwithstanding what Kæmpfer incidentally mentions to the contrary. M. Peschier, a chemist of Geneva, discovered in the husk of the fruit an acid, to which he gives the name of *acide geygoïque* (see "Bibliothèque Universelle de Genève," as quoted in Ann. de la Soc. d'Hort. de Paris, xv. 95). Bunge says that the Chinese plant a number of young trees of the *Salisburia* together, in order to produce a monstrous tree, by inarching them into one another; but Delille thinks that this may probably have been done in order to unite male and female trees, for the sake of fertilising the fruit. In Europe, hitherto, the use of the tree has chiefly been as a botanical ornament; but it is suggested by Loiseleur Deslongchamps and others that, as it grows with great rapidity in the South of France, it may be planted as a timber tree, and applied to the same uses as the Ash, of which it has the advantage of being more solid and having a greater specific gravity

Ginkgo biloba has in several Danish gardens attained a height of nearly 30 feet, and a circumference of the stem of about 3 feet.*

Professor Schübelér says in his "Viridarium" that the only place where this plant is to be found in Norway is the Botanic Gardens at Christiania. In 1839 a specimen four or five years old was planted against a wall facing east, where it grew luxuriantly. The stem had in 1885 a circumference of 22 inches, and the crown was 10 feet high and 7 to 8 feet broad.

In Southern Sweden, in Skaane and on Gothland, there are to be found examples that are 10 to 15 feet high, but there also the tree grows very slowly.

It seems as if this tree will live at Viborg, in Finland (60° 45') ("Tidning för Trädgårdsodlare," *Journal of Horticulture*, Stockholm, xx. 52). At Riga (56° 57') it does well (Johannes Klinge, "Die Holzgewächse von Est, Low- und Curland," Dorpat, 1883, p. 3).

20. PHYLLOCLADUS.—L. C. Rich. Conif. 129, t. 3; Hook. Icon. vi. tt. 549, 550, 551; A. Rich. Pl. Nov. Zeland. 363; Endl. Conif. 234; Hook. fil. Fl. of New Zealand, i. 234; Carr. Conif. 498 and 704; Gord. Pin. 139; Henk. and Hochst. Nadelh. 370. Podocarpi sp. Labill. Nov. Holl. ii. 71, t. 221. Brownetera, Rich. Mss. Robertia, Rich. Mss. Thalamia, Spreng. Anleit. ii. 218.

Flowers monœcious, and in close terminal clusters.

Fruit in small, connected heads, with a fleshy aril.

Seeds solitary, very small, half enclosed at the base by the fleshy aril, and nut-like, with a thin shell.

Leaves minute, scale-like bodies, on the margins of the branchlets; branchlets leaf-like, opposite, pinnate, or fan-shaped and feather-veined.

Cotyledons two.

Name derived from *phyllon*, a leaf, and *klados*, a branch—leaf-like branchlets.

All trees, found in New Zealand, Borneo, and Tasmania.

P. rhomboidalis, L. C. Rich. Conif. 130, t. 3, f. 2. *Podocarpus aspleniifolia*, Labill. Nov. Holl. ii. 71, t. 221. *Salisburia Billardierii*, L. C. Rich. Mss.; Endl. Syn. Conif. 235; Knight, Syn. Conif. 48; Lindl. and Gord. Journ. Hort. Soc. v. 226; Carr. Man. des Pl. iv. 377, and Tr. Gén. Conif. 500; Gord. Pinet. 141, and suppl. 43.

* Specimens of the "Maidenhair-tree" exist in the following places in England, viz.:—(1) Whitfield, near Hereford, in 1868 was 50 feet high, girth 7 feet 2 inches at 5 feet from the ground; (2) Panshanger, 53 feet high in 1868, girth 8 feet at 6 feet from the ground; (3) Blaize Castle, Henbury, 1879, a specimen 65 feet high; (4) Broadlands, 1882, 40 feet high, girth 7 feet at 3 feet up, spread of branches 45 feet; (5) Royal Gardens, Kew, 1889, 60 feet high, girth 9 feet 3 inches at 4 feet up, spread of branches 44 feet; (6) an old tree of smaller dimensions also exists in Chelsea Botanic Garden.

P. Billardierii, Mirb. in Mém. Mus. xiii. 76. *P. aspleniifolia*, Hook. fil. in Lond. Journ. of Bot. iv. 151. *Thalamia aspleniifolia*, Spreng. Syst. iii. 890. *Phyllocladus serratifolia*, Noisette, ex Gord. Pinet. suppl. l.c.; Hook. Fl. of Tasm. i. 358. *Taxus serratifolia*, Noisette, ex Gord. l.c.

Habitat.—Tasmania, on low and moist ground.

Introduced into Europe in 1825.

Wintered indoors.

P. trichomanoides, Don in Lamb. Pinet. ed. 2, ii. app.; A. Cunningham. in Ann. of Nat. Hist. i. 211; Hook. Ic. t. 549-551; Endl. Syn. Conif. 235; Lindl. and Gord. Journ. Hort. Soc. v. 226; Knight, Syn. Conif. 49; Hook. Fl. of New Zeal. 235; Carr. Man. des Pl. iv. 377, and Tr. Gén. Conif. 499; Gord. Pinet. 142, and suppl. 43. *P. rhomboidalis*, A. Rich. Fl. Nov. Zel. 363 (not L. C. Rich.).

Habitat.—New Zealand, in the forests near Tamesin.

Wintered indoors.

A graceful tree, with a straight cylindrical stem and spreading branches, growing 60 or 70 feet high, and 3 or 4 feet in diameter, found in the forests of Tamesin, on the northern island of New Zealand, where it is called by the natives Tanekaha and Toa-Toa. The timber is hard and heavy, and the bark is used by the natives of New Zealand for drying their mats of a red or black colour.

SERIES B.

TRIBE IV.—*PODOCARPEÆ*.

21. *DACRYDIUM*.—Sol. ex Forst. Pl. Esc. 80; Lamb. Pin. ed. 1, 93; Rich. Conif. 127, t. 2, f. 2; Endl. Gen. Pl. n. 1801, and Conif. 224; Hook. fil. Fl. of New Zeal. 233, and Fl. of Tasm. 357; Carr. Conif. ed. 1, 485, and ed. 2, 690; Gord. Pin. 73; Henk. and Hochst. Nadelh. 405. *Allania*, Colenso in Lond. Journ. of Bot. i. 301. *Thalamia*, Spreng. Syst. Veg. iii. 890. *Microcachrys*, Hook. fil. in Lond. Journ. of Bot. iv. 149, and Fl. of Tasm. 358, t. 100; Parl. in D. C. Prodr. xvi. 2, 494; Brongn. and Gris. in Bull. Soc. Bot. Tr. xvi. 328, and in Nouv. Arch. Mus. Par. iv. 5, t. 2; Eichl. in Engl. and Prantl. Natürl. Pfl. ii. 106.

Flowers dioecious.

Fruit fleshy and erect.

Seeds with a hard, bony shell, resting in a short, cup-shaped, fleshy aril.

Leaves needle-shaped or scale-like, and opposite.

Name derived from δάκρυ (*dakru*), a tear, in reference to the gummy exudation of the trees.

Trees and shrubs, natives of Tasmania, New Zealand, the East Indies, and New Caledonia.

Eichler, in "Die natürlichen Pflanzenfamilien," refers *Dacrydium* to *Podocarpeæ*; but in his Syllabus he, like Benth. and Hook., assigns it to *Taxææ*.

D. cupressinum, Sol. ex Forst. Pl. Esc. 80, and Prodr. 92; Lamb. Pinet. ed. 2, iii. 117, t. 51; Rich. Conif. 16, t. 2, f. 3; A. Rich. Fl. Nov. Zel. 361; A. Cunningh. in Ann. of Nat. Hist. i. 214; Endl. Syn. Conif. 225; Lindl. and Gord. Journ. Hort. Soc. v. 225; Knight, Syn. Conif. 48; Hook. fil. Fl. of New Zeal. 233; Carr. Man. des Pl. 375, and Tr. Gén. Conif. 486, and ed. 2, 691; Gord. Pinet. 74. *D. Lobbii*, hort. aliq. *Thalamia cupressina*, Spreng. Syst. iii. 890.

It is the typical tree of the western district of the North Island, New Zealand.

Wintered indoors.

D. Franklinii, Hook. fil. in Lond. Journ. of Bot. ser. 2, iv. 152, t. 6; Endl. Syn. Conif. 227; Lindl. and Gord. Journ. Hort. Soc. v. 225; Knight, Syn. Conif. 48; Carr. Man. des Pl. iv. 376, and Tr. Gén. Conif. 490; Gord. Pinet. 75; Hook. fil. Fl. of Tasm. i. 357; Henk. and Hochst. Syn. der Nadelh. 408; Carr. Tr. Gén. Conif. ed. 2, 695; Veitch, Man. Conif. 319. *D. huonense*, A. Cunningh. Mss.

Habitat.—Tasmania, near the river Huon and towards the port of Macquarie.

A large pyramidal tree, with spreading or pendent branches, thickly clothed with spray, growing 100 feet high and 20 feet in circumference. Timber excellent for naval purposes.

Wintered indoors.

22. MICROCACHRYS.—Hook. fil. Benth. Fl. Austral. vi. 240; Hook. Ic. Pl. t. 250; Bot. Mag. t. 5576 (1866); Eichl. in Engl. and Prantl. Natürlich. Pfl. ii. 103, 104, with illus.; Carr. Conif. ed. 2, 687; Henk. and Hochst. Syn. der Nadelh. 408; Hook. fil. in Lond. Journ. of Bot. iv. 149 (*in parte*), and Fl. of Tasm. i. 358; Endl. Syn. Conif. 227; Gord. Pinet. 134.

Flowers dioecious; the male catkins oval-oblong or cylindrical, and in clusters on the ends of the smaller branchlets; the female oval-obtuse, or globular, erect, and terminal.

Fruit very small, nearly globular, terminal, nodding, somewhat fleshy, bright red, and composed of numerous small scales.

Scales spreading, loosely imbricated, oval-rhomboid, thick, rather fleshy, bright red, and from twenty to thirty in number.

Seeds egg-shaped, solitary at the base of each scale, larger than the scales, more or less exposed, and with a thin bony shell.

Leaves ovate, scale-formed, very small, closely imbricated in four rows, and of a deep glossy green colour.

Name derived from *mikros*, small, and *cachrys*, a fir cone, the cones being remarkably small.

This genus consists of but one prostrate evergreen shrub found abundantly on the hills of Port Cypress, and on the top of the western mountains of Van Diemen's Land. It is cultivated in greenhouses.

M. tetragona, Hook. fil. in Lond. Journ. of Bot. iv. 150 (not Arch. in Hook. Journ. Bot. ii. 51), and Fl. of Tasm. t. C. B. (*in parte*); Carr. Man. des Pl. iv. 376 (*in parte*), and Tr. Gén. Conif. 62 (*in parte*); Gord. Pinet. 134 (*in parte*); Carr. Rev. Hort. 1866, 270 (*cum ic.*). *Pherosphæra Hookeriana mas*, Arch. l.c. *Arthrotaxis* (?) *tetragona*, Hook. Ic. t. 560 (Gunn, n. 367), and Fl. of Tasm. pl. 100. *Dacrydium* sp. (?)

Habitat.—On the summit of some of the western mountains of Tasmania.

Wintered indoors.

23. SAXEGOTHEA.—Lindl. in Paxt. Flow. Gard. 1851-2, 111, and in Journ. Hort. Soc. vi. 258; Cl. Gay, Fl. Chil. v. 411; Carr. Conif. 481, 684; Gord. Pin. 300; Henk. and Hochst. Nadelh. 410; Parl. in D. C. Prodr. xvi. 2, 497; Gord. Pin. 300; Eichler in Engl. and Prantl. Natürl. Pflf. ii. 103; Veitch, Man. Conif. 315; Beissner, Nadelholz. 16, 135.

Flowers monœcious; male flowers in spikes, female in globular heads.

Fruit composed of several thickened scales, formed into a solid fleshy cone.

Seeds pale brown, glossy, oval, with a short, thin, jagged membrane, enveloping the base of the seed only.

Leaves alternate, scattered, more or less two-ranked, leathery, and flat.

Named in compliment to his Royal Highness Prince Albert.

A large bush or small tree; found on the mountains of Patagonia.

S. conspicua, Lindl. in Paxt. Flower Gard. 1851-2, 111.

Habitat.—Valdivian and Chilian mountains; Patagonia.

Introduced into England in 1849 by William Lobb.

Only young plants have been tested out of doors in Denmark. The hard winter of 1890-91 did not hurt the plants, which were only covered with dead leaves over the roots and some few Spruce branches over the tops.

24. PODOCARPUS.—L'Herit. Mss.; Kunth in Humb. and Bonpl. Nov. Gen. et Sp. ii. 2; Rich. Conif. 124; Endl. Gen. Pl. 262, n. 1800, and Conif. 206; R. Brown in Horsf. Pl. Jav. Rar. 35; Carr. Conif. 436, and ed. 2, 643; Gord. Pin. 268; Henk. and Hochst. Nadelh. 377. *Taxi* sp. Thunb. Willd. *Juniperi* sp. Roxb.

Pavon. *Nageia*, Gærtn. de Fruct. i. 191, t. 39; Gord. Pin. 135; Carr. Conif. ed. 2, 635; Parl. in D. C. Prodr. xvi. 2, 507; Brongn. and Gris. in Bull. Soc. Bot. Tr. xiii. 425, xvi. 325; Benth. Fl. Austral. vi. 246; C. Koch, Dendr. ii. 105; Eichl. in Engl. and Prantl. Natürl. Pfl. ii. 104. *Podocarpus* (sect. *Nageia*), Endlich. Syn. Conif. 207; Carr. Man. des Pl. iv. 368, and Tr. Gén. Conif. 437. *Calophyllus*, J. E. Nelson, Pinac. (*pro parte*), 154.

Flowers diceious, rarely monœious.

Fruit drupaceous, inverted, and adhering.

Seeds hard and bony-shelled.

Leaves either opposite, alternate, or scattered, linear or oblong, and one-nerved.

Cotyledons two.

Name derived from *πούς*, a foot, and *καρπός*, a fruit—fruit foot-stalked.

All natives of the temperate zones of Asia, Africa, and America.

P. alpina, R. Br. ex Mirb. in Mém. Mus. xiii. 75; Bennett in Horsf. Pl. Jav. Rar. 40; Hook. fil. in Lond. Journ. of Bot. ser. 2, iv. 150; Endl. Syn. Conif. 214; Lindl. and Gord. Journ. Hort. Soc. v. 223; Carr. Man. des Pl. 371, and Tr. Gén. Conif. 456, and ed. 2, 652 (not Gord. Pinet. 268).

Habitat.—Tasmania, Mount Wellington, at 4,650 feet elevation, and on the somewhat lower grounds of Marlborough; also in south-east New Holland, in Victoria, &c. Wintered indoors.

P. chilina, Rich. in Ann. Mus. xvi. 297, and Conif. 11, t. 1, f. 1; Endl. Syn. Conif. 212; Knight, Syn. Conif. 47; Cl. Gay, Fl. Chil. v. 401; Carr. Man. des Pl. iv. 370, and Tr. Gén. Conif. 448, and ed. 2, 649; Gord. Pinet. 270. *P. saligna*, Don in Lamb. Pinet. ed. 2, ii. 120.

Habitat.—Grows in great numbers on several mountains of Chili. Introduced in 1853. Wintered indoors.

P. chinensis, Wall. List. n. 605; Endl. Syn. Conif. 213 (excl. syn. *longifolia* and *verticillata*, hort. and *macrophylla*, Don); Lindl. and Gord. Journ. Hort. Soc. v. 223; Blume, Rumph. iii. 216; Carr. Man. des Pl. iv. 371, and Tr. Gén. Conif. 457; Gord. Pinet. 271, and suppl. 87. *Taxus chinensis*, Roxb. Hort. Bengal, 73. *Juniperus chinensis*, Roxb. Fl. Ind. Orient. iii. 840. (?) *Taxus macrophylla*, Thumb. Fl. Jap. 276. *P. macrophylla* β *Maki*, Endl. l.c. 216; Lindl. and Gord. l.c. 224; Blume, l.c. *P. Makoya*, Forb. Pinet. Wob. 218. *P. Makoyi*, Hortus Lovan.; Blume, Rumph. iii. 216. *P. Maki*, Sieb. and Zucc. Fl. Jap. t. 134. *P. Makoyae*, hort. *P. macrophylla*, var. *Maki*, Neumann, Rev. Hort. 1848, 41 (*cum ic.*).

Habitat.—Japan, near Nagasaki; at Yeddo, on Nippon; and in China, in Yunnan.

Introduced in 1804.

According to Thunberg, the white wood is exceedingly durable, and is never attacked by insects. Wintered indoors.

P. elongata, Herit. Mss. ; Rich. Conif. 13, t. 1, f. 2, and Fl. Abyss. v. 278 ; Endl. Syn. Conif. 218, 219 ; Lindl. and Gord. Journ. Hort. Soc. v. 224 ; Carr. Man. des Pl. iv. 372, 373, and Tr. Gén. Conif. 470, 472 ; Gord. Pinet. 273, 286. *Taxus elongata*, Sol. in Ait. Hort. Kew. ed. 1, iii. 415. *Taxus capensis*, Lamb. Dict. iii. 229. *P. pruinosa*, E. Meyer, Mss. *P. Meyeriana*, Endl. Syn. Conif. 218 ; Lindl. and Gord. Journ. Hort. Soc. v. 224 ; Carr. Man. des Pl. iv. 372, and Tr. Gén. Conif. 472, and ed. 2, 671. *P. falcata*, R. Br. ex Mirb. in Mém. Mus. xiii. 75 ; Lindl. and Gord. Journ. Hort. Soc. v. 224. *P. linearis*, hort. ex Gord. Pinet. 273.

Habitat.—The Cape, and Abyssinia, about 6,500 feet high, in the province of Godjana. Wintered indoors.

P. japonica, Hort. Bogor. ex Sieb. in Ann. Soc. d'Hort. Pays-Bas. 1844, 35, 36 ; Endl. Syn. Conif. 217 ; Lindl. and Gord. Journ. Hort. Soc. v. 224 ; Carr. Man. des Pl. iv. 372, and Tr. Gén. Conif. 464 ; Gord. Pinet. 275. *P. lanceolata*, Gord. l.c. *P. longifolia*, hort. aliq.

Habitat.—Japan, in the southern parts.

Introduced about 1851.

P. macrophylla, Don in Lamb. Pinet. ed. 2, ii. 123 ; ieb. and Zucc. Fl. Jap. Fam. Nat. ii. 108, and Fl. Jap. 133 ; Blume, Rumph. iii. 215 (not Wall.) ; Endl. Syn. Conif. 216 (excl. *P. Maki* and its syn.) ; Lindl. and Gord. Journ. Hort. Soc. v. 224 (excl. *P. Maki*) ; Knight, Syn. Conif. 47 (excl. syn. *Maki*, *Makoyi*, and *Makaya*) ; Carr. Man. des Pl. iv. 371, and Tr. Gén. Conif. 463 ; Gord. Pinet. 278, and suppl. 89. *Maki Fectens*, Kæmpf. Amoen. Exot. 780. *Taxus macrophylla*, Banks, Ic. Kæmpf. t. 24. *P. verticillata*, hort. aliq. *P. spinulosa*, hort. aliq. (not R. Br.). *P. mucronata*, hort. aliq.

Habitat.—Japan.

Introduced into Europe about 1804 (Loud. Arbr. et Frut. p. 2000).

A plant under a slight covering of Spruce-branches stood the winter of 1890-91 very well, and seems to be almost hardy.

P. neriifolia, R. Br. in Horsf. Pl. Jav. Rar. 40 ; Don in Lamb. Pinet. ed. 2, iii. 122 ; Endl. Syn. Conif. 215 ; Lindl. and Gord. Journ. Hort. Soc. v. 224, and Fl. Serr. viii. 49 (*cum ic.*) ; Carr. Man. des Pl. iv. 371, and Tr. Gén. Conif. 458, and ed. 2, 661 ; Gord. Pinet. 279, and suppl. 89. *P. macrophylla*, Wall. List. n. 6052 (not Don).

Habitat.—Nepaul, Singapore and Penang.

Introduced about 1829. Wintered indoors.

P. spinulosa, R. Br. ex Mirb. in Mém. Mus. xiii. 75 ; Endl. Syn. Conif. 213 ; Lindl. and Gord. Journ. Hort. Soc. v. 223 ; Carr. Man. des Pl. iv. 370, 371, and Tr. Gén. Conif. 453, 455, and ed. 2, 653, 654 ; Gord. Pinet. 269, 277, 283. *Taxus spinulosa*, Smith in

Rees' Cyclop. n. 7. *P. pungens*, Caley, Mss.; Don in Lamb. Pinet. ed. 2, ii. 124. *P. excelsa*, Lodd. Cat. 1836, 37. *P. Bidwillii*, Hoibr. in Hort. Hug. *P. Laurencii*, Hook. fil. in Lond. Journ. of Bot. ser. 2, iv. 151. *P. alpina* β *Laurencii*, Hook. fil. Fl. of Tasm. i. 356.

Habitat.—Eastern New Holland. Wintered indoors.

P. taxifolia, Humb. Bonpl. and Kunth, Nov. Gen. et Spec. ii. 2, t. 97; Rich. Conif. 15, t. 29, f. 1, B.C.; Endl. Syn. Conif. 219; Lindl. and Gord. Journ. Hort. Soc. v. 224; Carr. Man. des Pl. 373, and Tr. Gén. Conif. 473, and ed. 2, 672; Gord. Pinet. 288, and ed. 2, 673. *Taxus montana*, Willd. Spec. iv. 587. *P. montana*, Lodd. Cat. 1836, 37. *Torreya Humboldtii*, Knight, Syn. Conif. 51. *Dacrydium distichum*, Don in Lamb. Pinet. ed. 2, iii. 120. *P. taxifolia communis*, Kunth, l.c.

Habitat.—Peru, 6,500 feet altitude, on the Saraguru, between Ono and Loxa. Wintered indoors.

P. Thunbergii, Hook. in Lond. Journ. of Bot. ser. 2, i. 657, t. 22; Endl. Syn. Conif. 217; Lindl. and Gord. Journ. Hort. Soc. v. 224; Carr. Tr. Gén. Conif. 470. *Taxus latifolia*, Thunb. Fl. Cap. ed. Schult, 547. *Taxus macrophylla*, Banks, Mss. in Herb. Jacq. *P. latifolia*, R. Br. ex Mirb. in Mém. Mus. xiii. 75 (not Wall. or Blume). *P. nobilis*, hort.

Habitat.—Cape of Good Hope. Wintered indoors.

P. Totara, Don in Lamb. Pinet. ed. 2, ii. app. (excl. syn.); A. Cunningham, in Ann. of Nat. Hist. i. 212; Hook. in Lond. Journ. of Bot. ser. 2, i. 572, t. 19; Endl. Syn. Conif. 212; Lindl. and Gord. Journ. Hort. Soc. v. 223; Knight, Syn. Conif. 47; Hook. fil. Fl. New Zeal. 233; Carr. Man. des Pl. iv. 370, and Tr. Gén. Conif. 451, and ed. 2, 652; Gord. Pinet. 284, and suppl. 90. *P. pungens*, hort. (not Caley). *P. spinulosa*, hort. (not R. Br.). *Dacrydium spinulosum*, hort. ex Gord. Pinet. suppl. l.c.

Habitat.—Northern part of New Zealand. The colonists call it the New Zealand Mahogany Pine. Wintered indoors.

24a. NAGÆIA, Gaertn.

Flowers monœcious or dioecious.

Fruit drupaceous, spherical, large, like a cherry.

Leaves without midrib, broad, ovate, and elliptic; sometimes long, attenuated, pointed at the summit, and reminding one somewhat of a Dammara. Fruits believed to ripen the second year.

N. japonica, Gaertn. Carpol. i. 191, t. 39; Gord. Pinet. 135, and suppl. 41. *Cupressus Bambusacea*, Otolanzan, Kwa-i, iv. 2. *Laurus julifera*, *Folio speciosa enervi*, Kæmpf. Amœn. Exot. 773 (ic.), l.c. 874. *Podocarpus Nagæia*, R. Br. ex Mirb. in Mém. Mus. xiii. 75, 76; Sieb. and Zucc. Fl. Jap. Fam. Nat. ii. 109, and Fl. Jap. t.

135 ; Endl. Syn. Conif. 207 ; Lindl. and Gord. Journ. Hort. Soc. v. 222 ; Carr. Man. des Pl. iv. 368, and Tr. Gén. Conif. 437. *Myrica Nagi*, Thunb. Fl. Jap. 76. *Dammara Veitchii*, Henk. and Hockst. Syn. der Nadelh. 216.

Habitat.—Japan, on the mountains of Nippon, in the provinces of Katsuga and Jamata.

Introduced about 1840. Wintered indoors.

25. PRUMNOPITYS, Phil. Henk. and Hockst. Syn. 369 ; Carr. Tr. Gén. des Conif. ii. 682.

This genus, of which there only exists one species, is by some authors referred to *Podocarpus* ; but Professor Philippi, the Chilian explorer, has made it a genus by itself, and no doubt he knows it better than most phytologists.

It is described as a tree 50-65 feet high, having some resemblance to certain varieties of *Taxus baccata*. The branches are numerous, and covered with brown bark. The leaves are more or less two-ranked, flat, straight, or a little curved, 15 to 20 mm. long and about 2 mm. broad. They are dark shiny green, but in culture sometimes a little greyish. They are slightly channelled on the under surface ; the midrib is very narrow, and on each side of it there is a glaucous line ; they are acuminate at the summit, and pointed or obtuse. The fruits are drupaceous, ovate, about 15 to 16 mm. long, greenish yellow, and the seeds are said to be catable.

P. elegans, Philippi in Linnæa, xxx. 371. *Taxus spicata*, Dombey, Mss. ex Mirb. in Mém. du Mus. xiii. 76. *Podocarpus spicata*, Poepp. Nov. Gen. et Spec. iii. 18. *Podocarpus andina*, Poepp. Mss. ; Endl. Syn. Conif. 219 ; Lindl. and Gord. Journ. Hort. Soc. v. 224 ; Cl. Gay, Fl. Chil. v. 403 ; Carr. Man. des Pl. iv. 373, and Tr. Gén. Conif. 474 ; Gord. Pinet. 286.

Habitat.—Chili, on the Southern Andes, up to an elevation of about 4,300 feet.

It was introduced into Europe in 1860 by Veitch's collector, Richard Pearse. In Denmark it has kept alive out of doors for several years. In the hard winter of 1890-91 an unprotected plant suffered much, but threw up young shoots from the older wood. It is more suited for culture in pots, but with protection it will perhaps live outdoors.

On the Continent it is rarely to be met with except in Western France, where, especially at Cherbourg, nice plants are to be seen. In Denmark, and in other countries as well, it is best known under the above-given name, *Prumnopitys elegans*, but some new authors prefer the name *Podocarpus andina*. In some works it seems that two different plants have been described under the two just named most common synonyms. The name *Prumnopitys* seems right for the plants in this country.

In the *Gardeners' Chronicle* for January 3, 1863, it is said of

Prumnopitys that if it is really a genus distinct from *Podocarpus*, there is no doubt that it nearly approaches to *P. andina*, Poeppig.

The wood is said to be very fine-veined, and consequently much valued by ebonists.

TRIBE V.—*ARAUCARIÆ*.

26. CUNNINGHAMIA.—R. Brown in Rich. Conif. 149, t. 18; Endl. Gen. Pl. n. 1796, and Conif. 192; Carr. Conif. 170, 227; Gord. Pin. 54; Henk. and Hockst. Nadelh. 217. *Pini* sp. Lamb. Pin. ed. 1, i. 52. *Abietis* sp. Desf. Catal. Hort. Paris, ed. 3, 356. *Belis*, Salisb. in Linn. Trans. viii. 315. *Raxopytis*, Nelson, Pin. 97; Parl. in D. C. Prodr. xvi. 2, 432; Forb. Pin. Wob. t. 57; Sieb. and Zucc. Fl. Jap. ii. t. 103, 104; Bot. Mag. t. 2743; Eichl. in Engl. and Prantl. Natürl. Pflf. ii. 85; C. Koch, Dendr. ii. 202.

Flowers monœcious, and terminal.

Cones small, ovoid or globular, and ligneous.

Scales acute-pointed, and without bracts.

Seeds three under each scale.

Leaves lanceolate, rigid, and flat.

Cotyledons two.

A small tree, native of China. Maximowicz observed it at Yokohama, where it was most likely planted.

Eichler, in his Syllabus (1886), like Benthams and Hooker, refers *Cunninghamia* and *Sciadopitys* to *Araucariæ*; but in 1887, in "Die natürlichen Pflanzenfamilien," he refers them to *Taxodiæ*, which forms a link to *Araucariæ*.

C. sinensis, R. Br. in Rich. Conif. 80, t. 18, f. 3. *Abies major sinensis*, &c. Plukn. Amalth. i. t. 351, f. 1. *Pinus Abies*, Lour. Fl. Coch. ii. 270 (excl. syn.). *Pinus lanceolata*, Lamb. Pin. ed. 1, i. 52, t. 34. *Abies lanceolata*, Desf. Cat. Hort. Paris, ed. 3, 356. *Cunninghamia lanceolata*, Lamb. Pin. ed. 2, 59, t. 37. *Belis jaculifolia*, Salisb. in Linn. Trans. viii. 315. *Belis lanceolata*, Sw. Hort. Brit. 475. *Araucaria lanceolata*, hort.

Habitat.—Southern China; in Japan it is cultivated.

This remarkable tree is a native of China, and was introduced in 1804 by Mr. William Kerr, by direction of the Honourable Court of Directors of the East India Company. It was first supposed to belong to the genus *Pinus*, and was called *Pinus lanceolata*, from its sharp lanceolate leaves; but, on more careful examination, it was made a separate genus by Mr. Salisbury, in the "Linnæan Transactions," under the name of *Belis*, from *belos*, a javelin—the leaves somewhat resembling in form the head of that weapon. The name of *Bellis* having been already applied to the daisy, that of *Belis* was considered

to bear too strong a resemblance to it, and accordingly it was afterwards changed by Mr. Brown to *Cunninghamia*, by which name it was first described by M. Richard in his "Mémoires sur les Conifères." For many years after it was first introduced it was kept in the greenhouse, but in 1816 a plant was turned out into a sheltered part of the pleasure-ground at Claremont.

It was named in compliment to Mr. James Cunningham, who discovered it in the neighbourhood of Canton in 1702.

Young plants did very well out of doors here in the winter of 1890-91; two or three of them were covered with leaves over the roots, and branches of Fir over the top, but such care seemed quite unnecessary, as the less protected plants succeeded even better.

It seems rare on the Continent, even in Germany.

27. DAMMARA (or *Agathis*). —Rumph. Herb. Amboin. ii. 174; Lamb. Pin. ed. 2, 70; Endl. Conif. 108; Hook. fil. Fl. of New Zeal. 231; Carr. Conif. 424, 677; Gord. Pin. 77; Henk. and Hochst. Nadelh. 209. *Pini* sp. Lamb. Pin. ed. 1, i. 61. *Abietis* sp. Poir. Dict. v. 35. *Agathis*, Salisb. Linn. Trans. viii. 311; Rich. Conif. 151, t. 19; Parl. in D. C. Prodr. xvi. 2, 374; Forb. Pin. Wob. t. 58, 59; Eichl. in Engl. and Prantl. Natürl. Pflf. ii. 66.

Flowers dioecious.

Cones ovoid or globular, and axillary.

Scales persistent, and without bracts.

Seeds unattached and solitary.

Cotyledons two.

Leaves petiolate or almost sessile, opposite or alternate, and leathery.

Name derived from its native one in Amboina, where the Malays call it Dammar "puti," or "batu," on account of the large quantity of resin it produces, which at first is soft, viscid, and transparent, but eventually becomes hard and like amber.

All large trees, natives of the East Indian Islands, New Zealand, New Caledonia, and New Guinea.

The *Dammara*s are distinguished from the true Pines and Firs by their broad, opposite or alternate, oblong-lanceolate, attenuated, leathery leaves, with parallel veins, and in the male and female flowers being solitary and on separate plants; they, however, approach nearest to the genus *Araucaria* in being dioecious, but they differ from it in the form of the scales, in the absence of a bract to each female flower, and in the seeds being winged only on one side, and free, or unattached.

D. australis, Lambert, Pin. ed. 2, ii. 73, t. 44; A. Cunningh. Ann. of Nat. Hist. i. 211; Loud. Arbor. iv. 2449, f. 2310, 2311, and Encycl. of Trees, 1066, f. 1990; Zucc. in Abhandl. der Mathem.

Phys. Klasse der Berl. Akadem. iii. t. 1, f. 2, t. 2, 16 (err.) and 17; Forb. Pinet. Wob. 179, t. 59; Spach, Hist. Vég. Phan. xi. 368; Endl. Syn. Conif. 190; Lindl. and Gord. Journ. Hort. Soc. v. 221; Knight, Syn. Conif. 45; Hook. fil. Fl. of New Zeal. 231; Carr. Man. des. Pl. iv. 363, and Tr. Gén. Conif. 427; Gord. Pinet. 77; Henk. and Hochst. Syn. der Nadelh. 211. *Agathis australis*, Salisb. in Linn. Trans. viii. 312.

Habitat.—New Zealand, in the northern parts.

Introduced into Europe in 1823.

Wintered indoors.

The Kauri Pine is a native of New Zealand, and is also frequently designated the Cowrie tree, or the Pitch tree. It is said to attain a height, in that country, of from 80 to 140 feet, producing a straight trunk, free from branches, to a height of from 40 to 70 feet, and is reckoned a very valuable tree for ship-masts and various other purposes. The branches are thickly clothed with leaves, which are of a lanceolate-oblong shape, erect, of a coriaceous texture, generally opposite, except on the old branches, when they are sometimes alternate, entire, obtuse at the apex, and occasionally slightly emarginate, from an inch to an inch and a half in length, and scarcely half an inch in breadth; of a shining pale green colour, and somewhat dilated at the base, not attenuated as in the other species. In Mr. Lambert's work on the genus *Pinus* we have some valuable remarks relative to the coniferous trees that are indigenous to New Zealand, by George Bennett, Esq., F.L.S., &c. The following is an extract from that gentleman's observations on the Kauri Pine: "This magnificent tree, which ornaments the New Zealand forests, is the *Dammara australis* of Lambert, and is called Kauri by the natives of New Zealand, which name probably was given on account of the great diameter it attains. It grows very erect, and attains a height of from 80 to 90 feet, and in diameter it is considered the largest tree in New Zealand. It occasionally attains 24 feet in circumference, and I have seen several cut down measuring from 16 to 20 feet. The timber is of excellent quality, close-grained, durable, and valuable for a variety of purposes, either in plank or spar; as yards and masts for shipping they have been found, by repeated trials, superior to all others, both in their flexibility as well as durability. The wood is of a white colour. The leaves of this Pine, when young, are alternate, but in form lanceolate, which changes, as the tree increases in growth, to an elliptical oblong form. This tree yields a large quantity of resin of a white and amber colour, very transparent, burning with a bright flame, and having a very agreeable smell. It exudes spontaneously and hardens on the trunk, but in much larger quantities on an incision being made in the tree and left for a night. On the following morning a large quantity is usually found to have exuded, and still continues to exude for a long time afterwards. This tree yields the

largest quantity of resin of all the New Zealand resiniferous trees. It resembles the resin named Dammara in the East Indies, and is, indeed, produced from a tree of the same genus, and might, consequently, be employed for similar purposes for which that resin is used in India, as pitch for ships, varnish, &c., and might form an article of commerce from New Zealand to the colonies of New South Wales and Van Diemen's Land, and England; from the quantity I have seen obtained from one tree, it may be collected abundantly in a short period of time. The natives name the resin *vare*, or the *wai* (water) of the tree."

D. Brownii, hort. *D. robusta*, Moore. *D. Brownii obtusa*, hort. *Habitat*.—New Zealand.

Introduced into France in 1855. Wintered indoors.

D. orientalis, Lambert. *D. alba*, Rumph. Herb. Amboin. ii. 174, t. 57; Blum. Rumph. iii. 212 (not hort.). *Arbor javanensis*, *Visci foliis latioribus, conjugatis*, *Dammara alba dicta*, Sherard in Rai Hist. iii. and Dendr. 130. *Pinus Dammara*, Lamb. Pinet. ed. 1, i. 61, t. 38; Voigt in Syllog. Pl. ii. 53. *Pinus sumatrana*, Hort. Belved.; Mirb. Mém. Mus. xiii. 69; Desf. Hort. Par. 356. *Abies Dammara*, Poir. Dict. v. 35. *Abies sumatrana*, Desf. l.c.; Mirb. l.c. *Agathis loranthifolia*, Salisb. in Linn. Trans. viii. 312, t. 15; Blume, Enumer. Pl. Jav. 90. *Agathis Dammara*, Rich. Conif. 83, t. 19. *D. loranthifolia*, Spach, Hist. Vég. Phan. xi. 336. *D. orientalis*, Lamb. Pinet. ed. 2, ii. 70, t. 43; Loud. Arbor. iv. 247, f. 2308, 2309, and Encycl. of Trees, 1066, f. 1989; Forb. Pinet. Wob. 169, t. 58; Endl. Syn. Conif. 189; Lindl. and Gord. Journ. Hort. Soc. v. 221; Knight, Syn. Conif. 45; Carr. Man. des Pl. iv. 363, and Tr. Gén. Conif. 425; Gord. Pinet. 79. *D. rubricaulis*, Knight, l.c.

Habitat.—The Molucca Islands, Sumatra, Java, and the Sunda Islands.

Introduced in 1804. Wintered indoors.

This species of Dammara is said to produce a tall, upright, straight stem, covered with smooth bark of a dark brown colour, and is much prized for the valuable quality of resin that exudes from the tree. Rumphius, in his "Herbarium Amboinense," lib. 3, cap. 10, gives the following interesting account of its produce: "The pellucid resin which flows from this tree is at first soft and viscous, but within a few days it becomes as hard as stone, and has all the transparency and clearness of crystal, especially that which adheres to the trees, and it will sometimes hang from them in the shape of icicles; that which flows over the ground, however, becomes black, and mixed with extraneous matter. These icicles (as they may be called) are sometimes as much as a hand in breadth and a foot in length, and exhibit an elegant striated appearance. For the first half-year the resin retains its whiteness and transparency, but

afterwards assumes a beautiful amber colour. It is brittle, and when broken shines like glass. It is much harder than the sort known by the name of Dammar Selanica, and in some degree admits of being bent; but when pounded it is friable. The product of the male trees is more white and pellucid, but dries more slowly, and exudes in a smaller quantity, whence little or none is collected from them. To force a supply of this substance, it is usual to make incisions in the lower part of the trunk with sharp knives. This occasions the formation of large knots in the wounded places, which protrude like heads, as in the Maple, are covered with dammar, and put forth a number of branches. The smell of fresh and soft dammar is perfectly odourless; but when dry this substance does not emit any particular odour; thrown on burning coals, it gives out a smell partaking of turpentine and mastic. It is very inflammable, and burns longer than the Dammar Selan, but without any crackling; though it emits a great quantity of acidulous smoke, which produces a very unpleasant effect on those who are unaccustomed to it. The common dammar, collected from the knots on the lower parts of the tree, is, when sold in the market, white and semi-transparent, but is liable to change colour, varying from reddish to horny, and even to black; nevertheless, it is always hard and semi-transparent. In this respect it is like the great masses and heads which hang from the thicker branches and oldest trees; for as these cannot, on account of their height, be ascended, the masses hang on them the longer, and so lose their original whiteness, and become of a horny colour. This circumstance is particularly remarkable on the Dammar trees about Way, whence I am led to believe that the variation of colour proceeds from the difference of the time of year, or from the time that the masses remain in their native situation. In the year 1688 I sent a piece of dammar to the University of Leyden, which in its form resembled the head of an infant, and by artificial means had been made to assume like features; but the nose was very ugly, and there were red marks near it resembling streaks of blood. I have also in my own possession a large white semi-transparent mass which resembles an immense ox's gall-bladder. Some of the crystalline branches sent to Holland did not retain their colour, but became there a sort of amber hue. The Malay name of 'Dammar puti' and 'Dammar batu' signifies stone resin, for it is the hardest of all the dammars, and approaches very near to the Gum animæ. Among the Ternats it is called only 'Salo,' or 'Salo bobuda'; in Amboina, 'Camal camar' and 'Cama'; about Lariquea, 'Isse'; and about Grisecca in Java, 'Dama.' The medicinal uses of this resinous substance have perhaps not yet been discovered. Some of the people of Amboina, however, whose feet have been wounded with thorns or splinters of wood, have no sooner extracted the latter than they have dropped into the

punctured parts a drop or two of burning dammar, which has prevented the formation of an ulcer, and scarcely created any pain in the callous hard soles of the Indians.

“To persons who write much (as clerks and secretaries), the dammar is of some use, for if they have occasion to scrape out a letter or a word, and will afterwards sprinkle a little of the powder on the place from which the erasure has been made, the paper is rendered smooth and susceptible of being again written on; but the letters soon become faint.

“The Dammara radja (called by the Ternaats ‘Salo colano’) is the same resin as that above described, but only the largest and most transparent pieces, which hang from the upper part of the trunk, free from impurities. That which is found in Batsjana and Hallemahera never turns yellow like the Amboina dammar, but is almost always white, and very gradually acquires any tinge of yellow; in taste and smell, however, it is the same, and collected from the same kind of tree. This sort alone is employed by the kings of the Moluccas as a suffumitory, whence it obtains the name of royal dammar, and the common people are prohibited from using it. There is some amusement in observing people unacquainted with this substance, who, meeting with it in the shops, take it to be lump sugar; as it is sold at a very cheap rate, the purchasers seek out the first corner to enjoy a taste of it, but immediately discover their mistake.

“In books of voyages we sometimes read of large quantities of mastic being found in these islands, but the substance alluded to is no other than the Dammar batu, which, when burnt, emits the same smell.”

28. ARAUCARIA.—Juss. Gen. 413; Rich. Conif. 153, t. 20, 21; Endl. Conif. 184, and Gen. Pl. 261; Carr. Conif. 413, 595; Gord. Pin. 21; Henk. and Hochst. Nadelh. 2. Dombeya, Lam. Fl. t. 828. Columbea (by many written as Colymbea) and Eutassa, Salisb. in Linn. Trans. viii. 315. Altingia, Don in Loud. Hort. Brit. 406. Araucaria and Eutacta, Link in Linnæa, xv. 541, 543; Parl. in D. C. Prodr. xvi. 2, 369; Lamb. Pin. t. 39, 40, (Dombeya) ii. t. 4, 5, ed. min. t. 56, 62; Forb. Pin. Wob. t. 50-56; Hook. Lond. Journ. Bot. ii. t. 18; Bot. Mag. t. 4635; Fl. des Serres, tt. 733, 1577, 1580, 2221; Brongn. and Gris. in Nouv. Arch. Mus. Par. vii. 205, t. 13-16; Eichl. in Mart. Fl. Bras. iv., i. 123, t. 110-112; C. Koch, Dendr. ii. 204; Eichl. in Engl. and Prantl. Natürl. Pfl. ii. 67; Veitch, Man. Conif. 187; Boissner, Nadelholzk. 18, 199.

Flowers dicecious, sometimes monœcious.

Cones globular or ovoid and terminal.

Scales deciduous, or partially so.

Seeds more or less attached to the scales.

Leaves scale-like, and widest at the base; spirally arranged on

the branches (*A. Bidwillii* is an exception); imbricated in some species and persistent many years; comparatively broad, flat, ovate-lanceolate, and very sharply pointed; or narrow 4-angled, and compressed; often curved.

Name derived from *Araucanos*, the people of Chili, in which country *Araucaria imbricata* abounds, and where its seeds furnish a great portion of the food of the Indians.

The *Araucarias* differ from the true Pines and Firs in having the sexes on separate trees; in the scales on the cones being one-seeded, and in the seeds being more or less attached to the scales. They, however, approach nearest to the genus *Dammara*, in being diceious, but differ from them in the form of the leaves and scales on the cones; also in having bracts to each female flower, and in the seeds being more or less attached to the scales, and not free as in the genus *Dammara*.

A. Bidwillii, Hook. in Lond. Journ. of Bot. ser. 2, ii. 498, t. 18, 19; Ant. Conif. 106, t. 46, 47; Endl. Syn. Conif. 187; Knight, Syn. Conif. 44; Lindl. and Gord. Journ. Hort. Soc. v. 220; Carr. Man. des Pl. iv. 361, and Tr. Gén. Conif. 418; Gord. Pinet. 22. *Columbea Bidwillii*.

Habitat.—The mountains of Brisbane and vicinity of Moreton Bay in Australia.

Introduced about 1849.

Wintered indoors.

A. brasiliensis, A. Rich. Dict. Class. Hist. Nat. i. 512; Lamb. Pinet. ed. 2, ii. 79, t. 46; Loud. Arbor. iv. 2439; Forb. Pinet. Wob. 161, t. 53, 54; Link in Linnæa, xv. 543; Ant. Conif. iii. f. 51-53; Spach, Hist. Vég. Phan. xi. 365; Endl. Syn. Conif. 185; Lindl. and Gord. Journ. Hort. Soc. v. 220; Knight, Syn. Conif. 43; Carr. Man. des Pl. iv. 361, and Tr. Gén. Conif. 415; Gord. Pinet. 23; Henk. and Hockst. Syn. der Nadelh. 2; J. E. Nelson, Pinac. 93. *A. Ridolfiana*, Savi in Atti della Terza Riunione degli Scienziati Italiani, tenuta in Firenze (1841), 458, 783, t. 2, 3, and Giornale Botanico, 1846, ii. 52. *Colymbea brasiliensis*, Carr. Tr. Gén. des Conif. 1867, ii. 596. *Pinus dioica*, Arab. Fl. Flum. x. t. 55, 56. *Colymbea angustifolia*, Bertol. Piante del Brasile, 1820, 7.

Habitat.—Brazil, between 15° and 25°; perhaps also in the northern part of the Argentine Republic.

Introduced in 1816.

We have wintered it indoors. A plant we tried to winter in a cold frame died.

A. Cookii, R. Br. ex Don in Linn. Trans. xviii. 164; Fl. Serr. vii. 243 (*cum ic.*); Paxt. Flow. Gard. ii. 132, and iii. 77, f. 272; Endl. Syn. Conif. 188; Lindl. and Gord. Journ. Hort. Soc. v. 220; Lindl. l.c. vi. 267 (*cum ic.*); Carr. Man. des Pl. 362, and Tr. Gén.

Conif. 421 ; Gord. Pinet. 27. *Eutacta Cookii*. *Cupressus columnaris*, Forst. Fl. Austral. n. 351. *Araucaria columnaris*, hort. aliq.

Habitat.—New Caledonia, Isle of Pines, Isle Aniteura, and in the New Hebrides.

We have wintered it in a frame.

A. Cunninghamii, Ait. Mss. ; Sweet, Hort. Brit. 475 ; Lamb. Pinet. iii. t. 79 ; Loud. Arbor. 2443, f. 2303-2305, and suppl. 2603, f. 2545 ; Ant. Conif. 102, t. 43, 44 ; Forb. Pinet. Wob. 157, t. 52 ; Endl. Syn. Conif. 187 ; Knight, Syn. Conif. 44 ; Lindl. and Gord. Journ. Hort. Soc. v. 220 ; Carr. Man. des Pl. iv. 361, and Tr. Gén. Conif. 419 ; Gord. Pinet. 27 ; Henk. and Hochst. Syn. der Nadelh. 9. *Altingia Cunninghamii*, G. Don in Loud. Hort. Brit. 408. *Eutacta Cunninghamii*, Link in Linnæa, xv. 545. *Eutassa Cunninghamii*, Spach, Hist. Vég. Phan. xi. 362.

Habitat.—The eastern coast of Australia, towards Moreton Bay, between 14° and 29° 30', where it constitutes waste forests ; also near the port of Brisbane at 27° 30'.

Introduced about 1827.

In some German gardening journals it was reported a few years ago that this species had ripened fruit planted out on a hill near Donaueschingen, in South Baden. This was a mistake ; the plant fruiting was a conservatory plant. I have tried a plant out of doors, but, although covered well, it lost its top even in a mild winter. Other plants have been wintered in a frame.

The Moreton Bay Pine much resembles *Araucaria excelsa*, and was first distinguished from it by Allan Cunningham in 1824, when he discovered the tree on the eastern coast of New South Wales, and also on the banks of the Brisbane River. The leaves differ from those of *A. excelsa* in being broader at the base, and standing out in a more horizontal direction from the branches ; those on the old wood are always reflexed towards the trunk of the tree, whilst those of the Norfolk Island Pine are pointing towards the extremities of the branches. The following interesting account of this species is given by Mr. Cunningham, F.L.S. : " This Pine was first seen by the late Sir Joseph Banks and Dr. Solander on the discovery of New South Wales by the immortal Cook in the year 1770. From 1774, when Norfolk Island was discovered in a subsequent voyage of that celebrated circumnavigator, and its Pines examined, on to the period of the voyages of Captain Flinders (to which was attached that eminent botanist, Mr. Brown), and down even to within about 1830, this noble tree was considered the same as that of Norfolk Island, although in the voyages of Captain King, whom I accompanied throughout his surveys, I had some reason to doubt its identity, from what I observed of its habit ; but it was not until my visit to the shores of Moreton Bay with the late Mr. Oxley, in 1824, that I had a favourable opportunity afforded me of satisfying myself on the banks of the

Brisbane—a river then recently discovered, falling into the bay—that it was a very distinct species, not simply in its habit of growth, which is very remarkable, but in the character of its leaves. On its being received into the Royal Gardens at Kew afterwards, it received the above name, which it appears has been since generally adopted by all who can boast of a living plant in their collections. On the coast of New South Wales it has a range of nine hundred miles, between the parallels of 14° and $29\frac{1}{2}^{\circ}$, but in no part, whether on the islands in the offing, on many of which it is the only timber, or on the main shore, has it been remarked of large size—rather appearing of a stunted irregular growth, and frequently broken down by the force of the prevalent winds. On the alluvial brushy banks, however, of the Brisbane River, between lat. 27° and 30° , where it is perfectly sheltered from every blast, it rises to the height of from 100 to 130 feet, with a girth of from 14 to 16 feet, or even more; and such specimens are frequently to be met with, having a clear, smooth, cylindrical barrel, 80 feet in height from the ground to the lowest branches. In my several geographical excursions in the highly interesting country lying to the westward of Moreton Bay, I met with this Pine at some distance from the banks of the Brisbane River, as also on the hills on the western side of the dividing range, in latitude 28° , at a distance from the coast of about eighty miles; beyond which, however, in any inland or western direction, it certainly does not exist. Its maximum, therefore, is evidently on the immediate coast, within the influence of the sea air, which, however, is not so essential to its existence as it appears to be for some of the plants I had discovered during Captain King's voyage, particularly some splendid species of *Grevillea*, which, in consequence, were found exceedingly difficult to cultivate at Kew, where they ultimately died, and were lost to Europe. This Pine bears young cones in the month of September. Its wood is a pale yellowish deal, and is commonly used in house carpentry, for making common furniture, and in boat-building at Brisbane Town. In the green state its spars have been formed into masts for vessels of two hundred tons, which are said to stand as long as the sap continues in them, but after becoming dry they are not to be depended on."

A. excelsa, R. Br. in Ait. Hort. Kew. ed. 2, v. 412; Lamb. Pinet. ed. 2, 81, t. 41; Forb. Pinet. Wob. 153, t. 50, 51; Loud. Arbor. iv. 2440, f. 2297-2302; Ant. Conif. 99, t. 38-42; Endl. Syn. Conif. 187; Knight, Syn. Conif. 44; Lindl. and Gord. Journ. Hort. Soc. v. 220; Carr. Man. des Pl. iv. 362, and Tr. Gén. Conif. 420; Gord. Pinet. 29; Henk. and Hochst. Syn. der Nadelh. 11; J. E. Nelson, Pinac. 93. *Dombeya excelsa*, Lamb. Pinet. ed. 1, i. 87, t. 39, 40. *Eutassa heterophylla*, Salisb. in Linn. Trans. viii. 316; Spach, Hist. Vég. Phan. xi. 362. *Altingia excelsa*, Loud. Hort. Brit. 400. *Colymbea excelsa*, Spreng. Syst. Cur. post. 315. *Eutacta excelsa*, Link in Linnææ, xv. 544.

Habitat.—Australia, especially on Norfolk Island ; also on parts of the continent.

This species has become very popular in Denmark. We have wintered it indoors and in a frame.

The Norfolk Island Pine is a beautiful-growing tree, frequently attaining in its native country 180 feet in height ; specimens of it have been seen that have even measured 228 feet in height by 14 feet in circumference. It was first discovered by Captain Cook, in his second voyage round the globe, on the extremity of New Caledonia, called Queen Charlotte's Foreland, and on a small neighbouring island, named by Captain Cook Botany Island, which is a mere sand-bank ; also on another island, called by our voyagers the Isle of Pines, from its being almost covered with the above-mentioned tree. Captain Cook states : " If I except New Zealand, I at this time knew of no island in the South Pacific Ocean where a ship could supply herself with a mast or a yard, were she ever so much distressed for want of one. Thus far the discovery is, or may be, valuable. My carpenter was of opinion that these trees would make exceedingly good masts. The wood is white, close-grained, tough, and light. Turpentine had exuded out of most of the trees, and the sun had inspissated it into a resin, which was found sticking to the trunks and lying about the roots. The trees shoot out their branches like all other Pines, but with this difference, that they are much smaller and shorter, so that the knots become nothing when the tree is wrought for use. I took notice that the largest of them had the smallest and shortest branches, and were crowned, as it were, at the top by a spreading branch like a bush. This was what led some on board into the extravagant notion of their being basalts." Captain Hunter also gives a very interesting description of this Pine. In his " Journal of the Transactions at Port Jackson and Norfolk Island," p. 194, he says : " The Pines which have been particularly spoken of by Captain Cook, and by others who have lately visited this island, are the most conspicuous of any trees here ; they grow to a prodigious size, and are proportionably tall, being from 150 to 200 feet, and in circumference from 12 to 14 feet, some to 28 and 30 feet. These trees, from their immense height, have a very noble appearance, being in general very straight and free from branches to 40 feet, sometimes 60 feet, above the ground. They have been by some thought fit for masts for ships of any size. In length and diameter they certainly are, but with respect to quality they are, in my opinion, wholly unfit ; even admitting them to be sound, which, from experience, I know is seldom the case. I employed the carpenters of the *Sirius*, while here, to cut down a few sticks, which it was intended should be sent home on the first opportunity, in order for trial in His Majesty's dockyards, to see if they were, as has been said, fit for His Majesty's navy or not. In providing a topmast and a topsail yard for a 74-gun ship, a

32, a 20, or a sloop, and one rough spar—in all seven sticks—thirty-four trees were cut down, twenty-seven of which were found defective. When these trees were falling, it was observed that most of them discharged a considerable quantity of clear water, which continued to flow at every fresh cut of the axe. There is no turpentine in these trees but what circulates between the bark and the body of the tree, and which is soluble in water. It is a very short-grained and spongy kind of timber, and I think fit only for house-building, for which we know it to be very useful. When first cut down, five out of six will sink in water; the wood is exceedingly heavy.”

A. imbricata, Pav. Mem. Acad. Madrid, i. 197. *Pinus Araucana*, Molin. Chil. 182. *Dombeya chilensis*, Lamb. Dict. ii. 301. *Dombeya Araucana*, Ræusch. Nomenclat. *Abies Araucana*, Poir. Suppl. v. 35. *Abies Columbaria*, Desf. Hort. Paris, 212. *Colymbea quadrifaria*, Salisb. in Linn. Trans. viii. 315. *Araucaria chilensis*, Mirb. in Mém. du Mus. xiii. 49. *Araucaria Dombeyi*, Rich. Conif. 86, t. 2021. *Quadrifaria imbricata*, Manett. ex Gord. Suppl. 14. *Colymbea imbricata*, Carr. Conif. ed. 2, 598.

Habitat.—On the mountains of Southern Chili, between 36° and 48° S., in large forests, and at some elevation on the mountains, where snow and ice remain for a great part of the year.

Introduced into Europe in 1795.

A noble tree, growing 150 feet high, and indigenous to Southern Chili, where it is found on the western acclivities of the Andes, often reaching the snow-line, but never more than 2,000 feet below it. The roots are for a long period of the year covered with snow. It forms vast forests in a part of the Andes inhabited by the Araucanians, a people who are said to pride themselves on their name, its signification being frank or free. It is found also in great abundance on the mountains of Caramavida and Naguelbuta in Chili, and in the neighbourhood of Concepcion. The Corcovada, a mountain that rises opposite Chiloe, is said to be studded from its foot to the snow-line with large groups of these beautiful trees.

The timber is hard, heavy, durable, yellowish-white, fibrous, and beautifully veined, capable of receiving a high polish, and easily worked.

The tree is full of a milky-white resin, and the Araucano Indians eat the nuts, either fresh, boiled, or roasted, and distil from them a spirituous liquor; dry and prepare a kind of flour and pastry from them, or dry them for winter store, and for trading to Concepcion and Valdivia, from whence they find their way to Valparaiso and Lima. It is the “Peghuen” or monkey-puzzle of the Chilians, no animal of that kind attempting to climb the trees.

Dr. Poeppig says such is the extent of the Araucarian forest on the Chilian Andes, and the amazing quantity of the nutritious seeds that each full-grown tree produces, that the Indians are ever secure from

want, the forests yielding to those nomad nations a vegetable substance that is found in greater plenty the more they recede from the whites. The kernels are dried, after being boiled, for winter use ; their time of ripening is towards the end of March, at which time the cones break up and fall to pieces, shedding their seeds on the ground, thus bestowing a great boon on the poor Indians, which nothing but a small parrot divides with them. And there is little doubt, when the numerous young *Araucarias* which are now being planted, or have been planted in Europe, become large, and arrive at a fruit-bearing state, but that as great a boon will be given to future generations as that conferred on the present one by the fruit of the Spanish chestnut, which is now so largely consumed in all the towns and cities of Europe. Fruiting trees are mostly found in Southern England and in Western France, especially near Brest.

There are several seedling varieties of the Chili Pine distinguished in the nurseries, but such differences are only retained while the plants are young, with the exception of the variegated kind (G. Gordon, "The Pinetum," 1875).

The Spaniards having settlements in the immediate vicinity of the country of the Araucanians, employed Don Francisco Dendariarena in 1780 to examine the trees, with a view of discovering if any of them were suitable for shipbuilding. The result of his experiments was to select this species (the Peghuen of the natives), which was accordingly made use of to repair the Spanish squadron, then lying at anchor in the port of Talcaguano. The Abbot Molina, who was then writing his "Civil and Natural History of Chili" (published at Bologna in 1782), supposed the tree to be a *Pinus*, and he described it in his work under the name of *Pinus Araucana*. In 1782 the Spanish Government commissioned Don Joseph Pavon to search for this tree ; and he, finding both its flowers and fruit, ascertained that it was a distinct genus, and called it *Araucaria imbricata*. Don Joseph Pavon (who had previously visited Chili, in company with Don Hipolita Ruiz and the French botanist Dombey, in 1777) sent specimens of *Araucaria imbricata* to France, to the care of Dombey, who showed them to MM. Lamarck and De Jussieu in Paris, the former of whom called it *Dombeya chilensis*, while Jussieu retained the name of *Araucaria*. Don Joseph Pavon, however, complains, in his account of this tree published in the first volume of the "Memoirs of the Royal Academy of Sciences at Madrid," that both Jussieu and Lamarck made several mistakes in their description of the botanical characteristics of the species which had been avoided by both Molina and himself. In 1795 Captain Vancouver touched at the coast of Chili, and Mr. Menzies, who accompanied the expedition, procured cones, seeds from which he sowed on board the ship, and brought home living plants, which he presented to Sir Joseph Banks, who planted one of them in his own garden at Spring Grove, and sent the

others to Kew. From this circumstance the tree was called at first, in England, "Sir Joseph Banks's Pine." The tree at Kew was kept in a greenhouse until about 1806 or 1808, when it was planted out where it now stands.

Don Joseph Pavon describes the wood of this tree as of a yellowish-white, fibrous, and full of beautiful veins, capable of being polished and worked with facility. He also states that it is well adapted for shipbuilding, as was proved by the experiments of Don Francisco Dendariarena in 1780. The resin, abounding in all parts of the tree, is white; its smell is like that of frankincense, and its taste not unpleasant. It is applied as a plaster to contusions, and for various medical purposes. The Indians regard the fruit as a very nourishing food; they eat it raw, as well as boiled and roasted, and distil from it a kind of spirituous liquor. They have stated times to collect the fruit, which they preserve to make use of as required (Lamb. Pin. ed. 2, ii. 108).

According to Pavon, the male tree, in its native country, grows only to 30 or 40 feet high, while the female reaches 150 feet in height. He gives the following account of it in a description published in the "Memoirs of the Royal Academy of Sciences at Madrid": "Its trunk is quite straight and without knots, ending in a pyramid formed of horizontal branches, which decrease in length gradually towards the top; it is covered with a double bark; the inner is 5 or 6 inches thick, spongy, tenacious, porous, and light, from which, as from almost all other parts, resin flows in abundance; the outer is of nearly equal thickness, resembling cork cleft in various directions, and equally resinous with the inner."

An *Araucaria imbricata* planted in 1870 in the gardens of the brewery at Carlsberg, near Copenhagen, has now reached a height of 24 feet and a circumference of the stem of 1 foot 10 inches. It is not at all spoilt, and has kept its branches quite to the ground. In the winter time it is covered with boards.

Molde (62° 44') is perhaps the most northern point in Norway where a healthy, though slow-growing, specimen of *Araucaria imbricata* is to be found. At Balestrand (61° 15') there is a plant of this species. In the winter of 1876-7 the thermometer went down to -14° C., and the cold continued till May 6th. In the winter of 1880-1, which was very severe in Norway, the thermometer again went down to -14° C., but the tree has flourished nevertheless. Balestrand is therefore the most northern place in the world where a healthy and fast-growing plant of *A. imbricata* is to be seen. It was planted in the spring of 1873, and was then about a foot high. The first winter it was covered with tan, but afterwards, till 1876, the ground was only covered with broken branches of *Juniperus communis*. Since then the plant has never been covered (Professor F. C. Schübeler, "Viridarium Norvegicum," 1886, p. 445). In September 1885 it

measured 13 feet 8 inches ; the circumference of the stem was sixteen inches.

In Sweden, Gothenburg ($57^{\circ} 42'$) is the most northern point where as yet success has been obtained with this species when planted out of doors.

A. Rulei, Lindl. in Gard. Chron. 1861, No. 39, 868 (*pro parte*, excl. icon.); Gord. Pinet. Suppl. 15 (*pro parte*); Mueller in Herb. Mus. Paris. *Eutacta Rulei*, Carr. Rev. Hort. 1866, 292, fig. 2.

Habitat.—South Australia, New Caledonia.

Introduced in 1862.

We have no plant in cultivation in Denmark, but I have cones of this species in my collection.

29. SCIADOPITYS.—Sieb. and Zucc. Fl. Jap. ii. 1, t. 102; Endl. Conif. 198; Carr. Conif. 173, and in Rev. Hort. 1868; Gord. Pin. 301. *Taxi* sp. Thunb. Flor. Jap. 276. *Pini* sp. Sieb. in Verhand. van het Batav. Genotsch. xii. 12; Parl. in DC. Prodr. xvi. 2, 435, and Fl. des Serres, t. 1483; C. Koch, Dendr. ii. s. 200; Henk. and Hochst. Syn. der Nadelh. 201; Lindl. in Gard. Chron. 1861, 22, 360; Dickson, Report Bot. Congr. Lond. 1866, 124; Eichl. in Engl. and Prantl, Natürl. Pfl. ii. s. 84; Beissner, Nadelholzk. 18, 203; Veitch, Man. Conif. 201.

Flowers monœcious, the male ones terminal, the female solitary, and growing from among the scaly buds.

Cones elliptic or cylindrical, obtuse at the ends, large, and solitary; 2 to 4 inches long, $1\frac{1}{4}$ to $2\frac{1}{4}$ inches in diameter.

Scales persistent, leathery, thin, regularly imbricated, wedge-shaped, half-rounded on the upper part, and with a short bractea adhering.

Seeds elliptic, compressed, seven under each scale, with a leathery covering, tapering into a membranaceous wing, attenuating to the base and apex.

Leaves in whorls like an umbrella, persistent, without any foot-stalks, linear, flat, and obtuse-pointed; 20-30 in a whorl.

Name derived from *skidos*, shade, and *pity*s, pine, the Parasol Pine.

S. verticillata, Sieb. and Zucc. Fl. Jap. ii. 1, t. 101, 102. *Taxus verticillata*, Thunb. Fl. Jap. 276 (excl. syn. Kæmpf. 1784). *Pinus verticillata*, Sieb. in Verh. van het Batav. Genotsch. ii. 12.

Habitat.—It is found in the eastern part of the island of Nippon, upon the mountains of Koja-san, in the province of Kii, and probably on other of the Japanese islands.

Introduced in 1861, through Mr. J. G. Veitch. It was sent to the late Mr. Standish of Ascot about the same time, by Mr. Robert Fortune (Veitch, Man. of Conif.).

Hardy.

The Parasol Fir, according to Mr. Fortune (who was sent out as

a plant collector by the Royal Horticultural Society), is a large pyramidal tree with horizontal spreading branches. It attains a height of from 100 to 150 feet, and from 10 to 11 feet in circumference three feet from the ground; and is not a large bush or small tree from 12 to 15 feet high, as originally stated by Dr. Siebold in his "Flora Japonica." The Japanese, however, have several varieties, among which some are dwarf bushes, others beautifully variegated, and others with leaves varying from two to four inches or more in length, and two lines broad; but all linear, a little sickle-shaped, blunt, or slightly notched at the points, leathery, double-ribbed, with a shallow channel running through them, and all spreading out horizontally like the ribs of a parasol, and so closely clustered alternately as to look as if they stood in whorls of from thirty to forty together at the ends of all the branchlets. Mr. Fortune says they are of a deep green colour, while, according to Dr. Siebold, they must be of a yellowish-green, and remain on the tree for about three years, by which time each branch has from one to three parasols on it, according to its age; but in the fourth year they fall off. The cones are elliptic or cylindrical, obtuse at the ends, and from $2\frac{1}{2}$ to 3 inches long, and $1\frac{1}{2}$ inch in diameter, and not unlike those of *Pinus Cembra*, but longer, and require two years to ripen. The seed-leaves are in twos, and very similar to those of the common Yew.

Dr. Siebold considers the Parasol Fir the finest Conifer of Japan, and one which presents an appearance as strange as elegant, in consequence of its innumerable branchings, which always end in a parasol-like tuft of leaves. Dr. Lindley says the *Sciadopitys* is nearly related to the genus *Wellingtonia*, a statement which seems very questionable, for, as far as my knowledge goes, the cones only bear any resemblance, and that not very marked.

Its Japanese names are "Koja-Maki" (the wild or Mount Kojasan Maki) and "Inu-Maki" (the spurious or false Maki); while those of the Chinese are "Kin-sung-Maki" (the pale yellow Maki) and "Kinsjo" (common yellow), on account of the leaves being of a pale or yellowish-green colour when young.

TRIBE VI.—*ABIETINEÆ*.

30. *PINUS*.—Linn. Gen. ed. 2, n. 879; Endl. Conif. 81, and Gen. Pl. 260; Parl. Fl. Ital. iv. 31. *Pinus*, *Abies*, and *Larix*, Tourn. Inst. 585, 586. *Pinus* and *Abies*, Linn. Gen. ed. 1, n. 731, 732; Juss. Gen. 414; Rich. Conif. 145, 147, t. 11-17. *Pinus*, *Picea*, *Abies*, *Larix*, and *Cedrus*, Link in Linnæa, xv. 482, 516, 525, 533, 537. *Pinus*, *Abies*, *Cedrus*, and *Larix*, Spach, Hist. des Vég. Phan. xi. 369, 403, 427, 431. *Tsuga*, *Abies*, *Picea*, *Larix*, *Cedrus*, and *Pinus*, Carr. Conif. 185, 195, 236, 269, 281, 291. *Abies*, *Cedrus*, *Larix*, *Picea*, *Pinus*, and *Pseudolarix*, Gord. Pin. 1, 39, 123, 143, 162,

292. *Pinus*, *Larix*, *Pseudolarix*, *Cedrus*, and *Abies*, Henk. and Hochst. Syn. der Nadelh. 19, 128, 139, 140, 147. *Keteleeria*, Carr. in Rev. Hort. ann. 1866, 449. *Tsuga*, *Pseudotsuga*, *Keteleeria*, *Abies*, *Picea*, *Larix*, *Pseudolarix*, *Cedrus*, and *Pinus*, Carr. Conif. ed. 2, 245, 256, 260, 265, 317, 351, 363, 366, 381; Parl. in DC. Prodr. xvi. 2, 377 (sub-genus); C. Koch, Dendr. ii. 269; Eichl. in Engl. and Prantl, Natürl. Pflf. ii. 70; Willk. Forstl. Fl. 161; Engelm. Rev. Gen. *Pinus*, in Trans. Acad. Sc. St. Louis, iv. 161, t. 1-3.

Flowers monœcious; the male catkins laterally placed in dense masses around the shoots in a kind of spike, the female solitary or in whorls, and terminal.

Cones more or less conical, and woody; some species keep them closed for many years.

Scales numerous, persistent, more or less elevated, pyramidal, swollen, and imbricated.

Seeds oval, with a hard bony shell, and either furnished with ample wings or wingless.

Cotyledons numerous.

Leaves in sheaths of two, three, or five in number, seldom only one; somewhat cylindrical, or concave on one side and convex on the other; persistent, and pointed.

All evergreen trees, found in Europe, Asia, and America, with one in Africa (*P. canariensis*).

It was Tournefort who, in 1700, was the first to clearly describe the pitch trees, and to distinguish those known at that time into the following genera as they stand to-day: *Pinus*, *Larix*, *Cedrus*, *Picea*, and *Abies*. Linnæus, fifty-three years later, in his "Systema Nature," crowded these genera all back into one genus as *Pinus*, while other families of *Gymnospermæ* found other places in his artificial system along with plants that are very different from them. Nearly a hundred years later, Bongard in 1834, Don in 1835, Link in 1841, Loudon in 1842, Spach in 1842, Endlicher in 1847, Carrière in 1855, Gordon in 1858, and Parlatore in 1868 reclassified and redescribed the cone-bearers, each scientist doing something towards eliminating the Pine from the rest, and each from the others, arriving ultimately at substantially the same classification that Tournefort had reached a hundred years previously. The Pines compose the largest genus of the *Coniferae*, and most of the species are very valuable.

P. albicaulis, Engelm. in Trans. Acad. of Sciences of Saint Louis, ii. 209. *P. flexilis*, James, var. *albicaulis*, l. c. *P. cembroides* Newberry, Rep. on Bot. Williamson's Exped. vi. 44, fig. 15 (not Zucc. nor Gord.). *P. Shasta*, Carr. Conif. ed. 2, 390.

Habitat.—Coast ranges of British Columbia, from the valley of the Letasyouco River (G. M. Dawson), south along the Cascade and Blue Mountains of Washington Territory and Oregon, extending east along the high ranges of Northern Washington Territory to the eastern

slope of the Rocky Mountains of Northern Montana (Old Maria's Pass, Canby and Sargent); California, Scott's Mountains, Mount Shasta, and on the high peaks of the Sierra Nevada to Mount San Bernardino.

A small alpine tree, 20-40 feet in height, with a trunk rarely 2 feet in diameter, or at its highest elevation reduced to a low, prostrate shrub; dry, gravelly ridges at the extreme limit of tree-growth, reaching in the San Bernardino Mountains an elevation of 10,500 feet (C. S. Sargent, "Forest Trees of North America").

The plant we have in Denmark bearing this name may not be right.

P. apulcensis, Lindl. Bot. Reg. 1839, app. 63; Spach, Hist. Vég. Phan. xi. 403; Loud. Encycl. of Trees, 1014, f. 1899, 1900; Endl. Syn. Conif. 153; Knight, Syn. Conif. 33; Lindl. and Gord. Journ. Hort. Soc. v. 215; Carr. Man. des Pl. iv. 349, and Tr. Gén. Conif. 316; Gord. Pinet. 216; J. E. Nelson, Pinac. 102. *P. acapulcensis*, G. Don in Sweet, Hort. Brit. ed. 3, 769. *P. Zacatlanæ*, Roezl, Cat. 1857-58, 26. *P. Pseudostrobus*, Roezl (not Lindley).

Habitat.—Mexico. Hartweg discovered it among the mountains of Acapulco. Introduced to Chiswick in 1839-40. As far as my knowledge goes we have no plant of this species in Denmark, but I possess cones brought home by the Danish botanist Liebmann and gardener Rath sack.

P. australis, Michaux, Arbr. For. i. 62, t. 6, and Sylv. N. Amer. 30, t. 141; Loud. Arbor. iv. 2255, f. 2156-2160, and Encycl. of Trees, 987, f. 1842-1845; Loisel. Nouv. Duham. v. 246, t. 75, f. 3; Spach, Hist. Vég. Phan. xi. 392; Endl. Syn. Conif. 165; Lindl. and Gord. Journ. Hort. Soc. v. 217; Knight, Syn. Conif. 30; Carr. Man. des Pl. iv. 353, and Tr. Gen. Conif. 345; Gord. Pinet. 187. *P. americana palustris*, Hort. Angl. 88; Duham. Arbr. ii. 126. *P. palustris*, Mill. Dict. n. 14; Soland. in Ait. Hort. Kew. ed. 3, 368; Du Roi, Harbk. ed. Pott. ii. 66; Wangenh. Beitr. 78; Willd. Baumz. 270; Lamb. Pinet. ed. 2, i. 30, t. 21; Forb. Pinet. Wob. 59, t. 22; Ant. Conif. 23, t. 6, f. 2; Desf. Hist. Arbr. ii. 612; Link in Linnæa, xv. 506. *P. georgica*, hort. ex Gord. l. c. *P. palmiensis*, ex Gord. Pinet. Suppl. 63. *P. Palmieri*, Manetti, ex Gord. Suppl. l. c.

Habitat.—South-eastern Virginia, south to Cape Canaveral and Tampa Bay, Florida, and through the Gulf States to the valley of the Red River, Louisiana, and the Trinity River, Texas, rarely extending beyond 150 miles from the coast.

A tree of the first economic value, 60-100 feet in height, with a trunk 2-4 feet in diameter. Dry, sandy loam of the maritime plain, generally of Tertiary formation, and forming, outside of the river bottoms, extensive forests almost to the exclusion of other species; or towards its extreme interior range, especially in the Gulf States, occupying rolling hills, and mingling with the Oak and various deciduous trees; rarely along the borders of swamps in low, wet soil.

Wood heavy, exceedingly hard, very strong, tough, coarse-grained, compact, durable; bands of small summer cells broad, occupying fully half the width of the annual growth, very resinous, dark-coloured, resin passages few, not conspicuous; medullary rays numerous, conspicuous; colour light red or orange, the thin sapwood nearly white; specific gravity, 0.6999; ash, 0.25; largely manufactured into lumber and used in construction of all sorts, for ship-building, fencing, railway ties, &c. (C. S. Sargent).

The turpentine, tar, pitch, resin, and spirits of turpentine manufactured in the United States are almost exclusively produced by this species ("U.S. Dispensatory," ed. 14, 709,899, and "Nat. Dispensatory").

In the "*Sylva Americana*" an interesting account of the properties of this Pine is given, from which the following is an extract:—

"This invaluable tree is known, both in the countries which produce it and in those to which it is exported, by different names. In the first it is called Long-leaved Pine, Yellow Pine, Pitch Pine, and Brown Pine; in the Northern States, Southern Pine and Red Pine; and in England and the West Indies, Georgia Pitch Pine. We have preferred the first denomination, because this species has longer leaves than any other eastward of the Mississippi, and because the names of the Yellow Pine and Pitch Pine, which are more commonly employed, serve in the Middle States to designate two species entirely distinct and extensively diffused. Towards the north, this tree first makes its appearance near Norfolk in Virginia, where the Pine-barrens begin. It seems to be especially assigned to dry, sandy soils, and it is found without interruption in the lower parts of the Carolinas, Georgia, and the Floridas, over a tract of more than 600 miles long from north-east to south-west, and more than 100 miles broad from the sea towards the mountains of the Carolinas and Georgia.

"The mean stature of the Long-leaved Pine is 60 or 70 feet, with a uniform diameter of 15 or 20 inches for two-thirds of this height. Some stalks, favoured by local circumstances, attain much larger dimensions, particularly in East Florida. The bark is somewhat furrowed, and the epidermis detaches itself in thin transparent sheets. The leaves are about a foot long, of a beautiful brilliant green, united to the number of three in the same sheath, and collected in bunches at the extremity of the branches; they are longer and more numerous on the young stalks. The buds are very large, white, fringed, and not resinous. The bloom takes place in April. The male flowers form masses of divergent violet-coloured aments, about 2 inches long; in drying they shed great quantities of yellowish pollen, which is diffused by the wind, and forms a momentary covering on the surface of the land and water. The cones are very large, being 7 or 8 inches long and 4 inches thick when open, and are armed with small retorted spines. In the fruitful year they are ripe about the middle of October, and shed their seeds the same month. The kernel is of

an agreeable taste, and is contained in a thin white shell, surmounted by a membrane ; in every other species of American Pine the shell is black.

“The wood of this tree contains but little sap ; trees 15 inches in diameter three feet from the ground frequently have 10 inches of heart. Many stalks of this size are felled for commerce, and none are received for exportation of which the heart is not 10 inches in diameter when squared. The concentric circles in a trunk fully developed are close and at equal distances, and the resinous matter, which is abundant, is more uniformly distributed than in the other species ; hence the wood is stronger, more compact, and more durable ; it is, besides, fine-grained and susceptible of a bright polish. These advantages make it preferable to every other Pine ; but its quality is modified by the nature of the soil in which it grows. In the vicinity of the sea, where only a thin layer of mould reposes upon the sand, it is more resinous than where the mould is five or six inches thick. The stalks that grow upon the first-mentioned soil are called Pitch Pine, and the others Yellow Pine, as if they were distinct species. This wood subserves a great variety of uses in the Carolinas, Georgia, and the Floridas : four-fifths of the houses are built of it, except the roofs, which are covered with shingles of the Cypress ; but in the country the roofs are also of Pine, and are renewed after fifteen or eighteen years. In naval architecture this is the most esteemed of the Pines ; in the Southern States, the keel, the beams, the side planks, and the pins by which they are attached to the ribs, are of this tree. For the deck it is preferred to the true Yellow Pine. In certain soils this wood contracts a reddish hue, and it is for that reason known in the dockyards of the Northern States by the name of Red Pine. The resinous product of the Pine is of six sorts, namely, turpentine, scrapings, spirit of turpentine, resin, tar, and pitch. The last two are delivered in their natural state, the others are modified by the action of fire in certain modes of preparation. More particularly, turpentine is the sap of the tree, obtained by making incisions in its trunk. It begins to distil about the middle of March, when the circulation commences, and flows with increasing abundance as the weather becomes warmer, so that July and August are the most productive months.”

Wintered in a frame in Denmark. We tried to winter one plant out of doors, a little covered. Cones in my collection measure 7 inches in length.

P. Ayacahuite, Ehrenb.

Habitat.—It is a native of the mountains of Northern Mexico, in the provinces of Chiapa and Oaxaca, where it occurs at elevations of between 7,000 and 11,000 feet ; it is also found on the higher peaks of mountains about Cosiquiriachi, in Northern Mexico. Introduced by Hartweg in 1840 for the Royal Horticultural Society.

A large tree, growing 100 feet high and 3 or 4 feet in diameter, with

very much the appearance of the Weymouth Pine (*P. Strobus*), found particularly on the higher points of the Cumbre Mountains, in the Sierra of Oaxaca, and on Mount Palado, or Bald Mountain. It is also very common on the mountains of Quezaltenango, at an elevation of 8,500 feet, and on the neighbouring mountain of Santa Maria, where it is called "Tablas" by the inhabitants, and "Ayacahuite" by the Mexicans. It is also found on the higher peaks of the mountains about Cosiquiriachi, in Northern Mexico, at an elevation of 7,000 or 8,000 feet. Timber white and soft.

A plant of this species has done well out of doors slightly covered with straw and Spruce branches. I possess remarkably fine cones brought home from Mexico by the Danish Professor Liebmann.

P. Balfouriana, Jeffrey in Engelmann's Rev. of the Genus *Pinus*, &c. 179; Rep. Oregon Exped. i. t. 3, f. 1; Gord. Pinet. 217; and ed. 2, 293; Henk. and Hochst. Nadelh. 109; Bolander in Proc. Calif. Acad. iii. 318; Carr. Tr. Gén. Conif. ed. 2, 425; Nelson, Pinac. 104; Hoopes, Evergreens, 149; Fowler in Lond. Gard. Chron. 1872, 973; Vasey, Cat. Forest Trees, 32; Engelm. in Trans. St. Louis Acad. iv. 179; Bot. Calif. ii. 125; Veitch, Man. Conif. 175; Lawson, Pinet. Brit. i. 11, f. 1-5.

Introduced from North California in 1852 by John Jeffrey; and, many years afterwards, reintroduced under the name of *Pinus aristata*, which is now regarded as a variety of *P. Balfouriana* (Veitch, "Manual of Conifers," 1891).

Habitat.—California, Scott's Mountain, Siskiyou County (Jeffrey, Lemmon), Mount Whitney, and about the headwaters of King and Kern rivers.

The specific name *Balfouriana* was given by Mr. Murray in compliment to the late Professor of Botany in the University of Edinburgh.

The young specimens growing in British gardens under the name of *Pinus aristata* are somewhat different from those regarded as the true *P. Balfouriana*. They are more robust, and of more rapid growth; the leaves are longer, stouter, duller in colour, and much less glaucous on the inner faces. The merits of *P. Balfouriana* as a decorative tree have yet to be proved.

A small tree, 50 to 60 feet in height, with a trunk 2 to 3 feet in diameter; dry, gravelly slopes and ridges, forming upon Scott's Mountain a broad belt of open forest growth at an elevation of 5,000 to 8,000 feet (C. S. Sargent).

Hardy.

P. B. aristata, Engelm.

This very singular variety is a truly alpine Conifer, constituting the highest belts of timber on the peaks of the Colorado Mountains in California, where on sheltered slopes, at elevations between 9,000 and 10,000 feet, it forms a trunk over 3 feet in diameter, covered with a

thin, scaly, light greyish-brown bark, not more than three or four lines thick even on old trees; but on the high bleak mountains of the Snowy Range, on Pike's Peak, and on the heights of the Coochetopa Pass, at an elevation of from 10,000 to 12,000 feet, it becomes a straggling bush, frequently prostrate or almost creeping, and thickly covered with cones. It, however, never descends to a lower elevation than 9,000 feet. The wood is white, tough, and not very resinous.

It was first introduced in 1870 by Mr. Cripps, of Tunbridge Wells (G. Gordon, "The Pinetum," 1875).

Seems to be hardy in Denmark.

P. Banksiana, Lamb. Pin. ed. 1, i. 7, t. 3; ed. 2, i. 7, t. 3, and ed. 3, i. 9, t. 3; Pers. Syn. ii. 578; Desf. Hist. Arb. ii. 611; Nouv. Duham. v. 234, t. 67, f. 3; Ait. Hort. Kew. ed. 2, v. 315; Pursh, Fl. Am. Sept. ii. 642; Smith in Rees' Cycl. xxviii. No. 4; Nutt. Gen. ii. 223, and Sylv. iii. 124, ed. 2, ii. 182; Spreng. Syst. ii. 886; Torr. Compend. Fl. N. States, 360; Beck, Bot. 339; Eaton, Manual, ed. 6, 265; Loud. Arbor. iv. 2190, f. 2064-2067; Forb. Pinet. Wob. 13, t. 3; Hook. Fl. Bor. Am. ii. 161; Eaton and Wright, Bot. 358; Ant. Conif. 8, t. 4, f. 2; Lindl. in Penn. Cycl. xvii. 171; Link in Linnæa, xv. 491; Spach, Hist. Vég. xi. 379; Endl. Syn. Conif. 177; Knight, Syn. Conif. 26; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 218 (excl. syn. *con-torta*); Parry in Owen's Rep. 618; Carr. Tr. Gén. Conif. 381, and ed. 2, 485; Gord. Pinet. 163, and ed. 2, 230; Richardson, Arctic Exped. 441; Cooper in Smithsonian Rep. 1858, 257; Hook. fl. in Linn. Trans. xxiii. 301; Wood, Cl. Book, 661; Henk. and Hochst. Nadelh. 44; Nelson, Pinac. 104; Gray, Manual N. States, ed. 5, 470; Hoopes, Evergreens, 78; Vasey, Cat. Forest Trees, 29; Macoun in Geolog. Rep. Canada, 1875-76, 211; Engelm. in Trans. St. Louis Acad. iv. 184; Sears in Bull. Essex Inst. xiii. 186; Bell in Geolog. Rep. Canada, 1879-80, 46; Veitch, Man. Conif. 158; Beissn. Nadelh. 218. *P. canadensis foliis curtis*, &c. Duham. Arb. ii. 126. *P. silvestris divaricata*, Ait. Hort. Kew. ed. 1, 3, t. 366. *P. hudsonica*, Lam. Dict. Encycl. v. 339. *P. rupestris*, Michx. Arb. Forest. i. 49, t. 2.

Habitat.—Bay of Chaleurs, New Brunswick, to the southern shores of Hudson's Bay; north-west to the Great Bear Lake, the valley of the Mackenzie River, and the eastern slope of the Rocky Mountains between the fifty-second and sixty-fifth degrees of north latitude; south to Northern Maine, Ferrisburg, Vermont (R. E. Robinson), the southern shores of Lake Michigan, and Central Minnesota.

A small tree, 20 to 70 feet in height, with a trunk rarely exceeding 2½ feet in diameter; barren, sandy soil, or less commonly in rich loam; most common north of the boundary of the United States, and reaching its greatest development in the region north of Lake Superior, here often forming considerable forests; toward its

extreme western limits associated and often confounded with the closely allied *P. contorta* and *P. Murrayana* of the Pacific region.

Wood light, soft, not strong, rather close-grained, compact; bands of small summer cells not broad, very resinous, conspicuous, resin passages few, not large; medullary rays numerous, obscure; colour clear light brown or (rarely) orange, the thick sapwood almost white; specific gravity, 0.4761; ash, 0.23; largely used for fuel, railway ties, &c. (C. S. Sargent).

P. Banksiana, Lamb., published in 1803 in Lambert's first edition of Pines a year prior to Poiret's name of *P. rupestris*—which name, erroneously preferred by Parlatore, must give way to the former—is probably the only Pine with erect, or at least patulous, cones. The small prickles of the very young cones soon disappear, so that the mature ones are unarmed. They keep a long time closed—often many years.

Dr. Mayr believes that the wood of *P. Banksiana* is not inferior to that of *P. silvestris* in quality. He therefore believes that the plant, although it never attains a great size, is really worthy of being chosen for forest culture on very poor ground, and he recommends it for that purpose.

As this Pine grows more to the north than any other species, there can be no doubt at all as to its hardiness. It is perhaps the species which gives the greatest quantity of cones. I think it would be interesting to graft it on a somewhat more vigorous species.

P. Banksiana is rare in Danish gardens; one specimen, however, planted in 1870, measures 21 feet in height and 15 inches in girth.

It has proved to be hardy in Stockholm.

P. Beardsleyi, Murr. (*P. ponderosa*). I find it still necessary to keep this species as distinct, although probably it may turn out to be *P. ponderosa*.

Hardy.

P. Boursierii, Carr. Rev. Hort. 1854, 225 (*cum ic.*), 333, and Tr. Gén. Conif. 398 (not Gord., nor Henk. and Hochst.). *P. Royleana* (?), Lindl. Journ. Hort. Soc. ix. (*cum ic.*); Gard. Chron. Jan. 28, 1854.

Habitat.—California, where it was found by the French Vice-Consul Boursier de la Rivière.

The first seeds were introduced in 1853.

Seems to be hardy.

P. Brownii. This plant may later on receive another specific name.

Hardy.

P. Bungeana, Zucc. Mss. in Endl. Conif. 166. *P. exorticata*, hort.

Habitat.—North-eastern China; also much cultivated, especially on the island of Chusan, &c.

Introduced into England in 1846 by the Royal Horticultural Society, through their collector, Robert Fortune, and named after A. v. Bunge, who travelled as a botanist in Siberia and China.

I have seen plants bearing cones in North-eastern France and Middle Western Germany, and suppose it might be able to stand Danish winters. We still have only young plants.

The native habitat of this tree is far to the north of China, between Peking and the western hills, one of the coldest and most desolate-looking districts in winter which an inhabited and cultivated country can well be. In summer the country, although treeless, is not without vegetation. Its plains are covered with crops of a kind of millet—a tall Sorghum, from six to nine feet high, with a hard stem as thick as a man's thumb, which in autumn is cut about knee-high, and which did infinite damage to the legs of the cavalry horses in the Peking war—and the gardens and neighbourhood of the houses of the inhabitants are gay with flowers and shrubs. But in winter all is changed; the crops being cut down, the plains are one extensive stubble; not a plant nor a tree to break the uniform desolate sameness is to be seen as far as the eye can reach, all the shrubs and plants having disappeared. Where they can have gone to at first appears inexplicable; but on inquiry it turns out that they have been taken up and carried in pots into outhouses, into cellars and holes underground, and wherever shelter can be obtained from the severity of the coming storm, which would otherwise kill them all. The hardiest evergreen cannot, unprotected, stand that piercing climate. Passing through these inhospitable regions to the mountains to the west, Mr. Fortune first met with this Pine in its native country and full-grown. In the south he had often seen small plants in pots, and knew the tree perfectly; but when he saw the strange aspect of the tree with its white leaves, he naturally rejoiced at the discovery of a new species. It was only when he came up to it that he found it was an old acquaintance. Being almost confined to cemeteries, and in such a treeless country, its lofty, white, many-pillared columns, so associated, formed an impressive and striking object (Pinet. Brit.).

P. canariensis, Chr. Smith in Buch. Beschreib. der Canar. Ins. 159; De Cand. Plant. Rar. Hort. Genev. i. t. 1, 2; Lamb. Pinet. ed. 2, i. 45, t. 28; Loud. Arbor. Brit. iv. 2261, f. 2162-2166, and Encycl. of Trees, 994, f. 1861-64; Pinet. Woburn. 57, t. 21; Antoine, Conif. 33, t. 15; Spach, Hist. Vég. Phan. xi. 393; Link in Linnæa, xv. 508; Webb and Berth. Flor. Canar. Geograph. Bot. 21, 148; Phytogr. Canar. sect. iii. 280; Miscell. Pl. 42, 43; Endl. Syn. Conif. 165; Lindl. and Gord. Journ. Hort. Soc. v. 217; Knight, Syn. Conif. 30; Carr. Tr. Gén. des Conif. 348; Gord. Pinet. ed. 1, 191, and ed. 2, 264; Henk. and Hochst. Syn. der Nadelh. 80; J. E. Nelson, Pinac. 106; Beissn. Nadelh. 251.

P. canariensis, a large tree, growing 60 to 70 feet high, is a

native of the islands of Teneriffe and Grand Canary, where it forms extensive forests from the seashore to an altitude on the mountains of 6,700 feet, though it is most abundant between 4,080 feet and 5,900 feet above the level of the sea, which may be considered as the Pine region of these islands. This Pine has been long noticed by travellers who visited Teneriffe; but it was confounded with *P. maritima*, *P. Texa*, and even *Larix europæa*, till the name of the species was settled by Professor Smith, of Christiania. In its general appearance, Messrs. Webb and Berthollet observe, *P. canariensis* resembles the European species, and the first view of a Pine forest in the Canaries is very similar to that of a Pine forest on the Alps. Under these gigantic trees the soil is dry and poor, and very few plants grow beneath their shade. The Pines grow on the margins of the valleys, and on the steep slopes and rugged precipices which form the sides of the mountains, but not on their summits (Hist. Nat. des Iles Canaries, Geog. Bot. p. 21). On the Grand Canary Island the Pine forests extend from Oratava to Portillo de la Villa.

The leaves of this Pine are sometimes in twos, but more frequently in threes, and the trees ascend on the slope of the Peak of Teneriffe to 7,200 feet of elevation; but the zone above 2,400 feet is wholly occupied by vast forests mingled with the *Juniperus Cedro* of Webb. The inhabitants call it "Teñ," and consider its timber excellent, being resinous, durable, and free from the ravages of insects (G. Gordon, "Pinetum," 1875).

P. canariensis is perhaps more nearly related to *P. Laricio* than to *P. ponderosa*. The articulation of the four involucreal bracts is a curious feature, which it has in common with *P. resinosa*.

Wintered indoors in Denmark.

P. Cembra, Linn. Spec. Pl. 1419; Du Roi, Harbk. ed. Pott. ii. 69; Willd. Baumz. 212; Lamb. Pinet. ed. 1, i. 34, t. 23, and ed. 2, i. 48, t. 30, 31; Loisel. Nouv. Duham. v. 56, t. 77; Pinet. Wob. 69, t. 27; Loud. Arbor. Brit. iv. 2274, f. 2188-2192; Encycl. of Trees, 1016, f. 1902-1905; Link in Linnæa, xv. 513; Antoine, Conif. 45, t. 20, f. 2; Villars, Fl. Delph. iii. 806; Allion, Fl. Pedem. ii. 179; De Cand. Fl. Franc. iii. 275; Desf. Hist. Arbr. ii. 612; Spach, Hist. Nat. Vég. Phan. xi. 398; Endl. Syn. Conif. 141; De Chambr. Trait. Prat. Arbr. Résin. 334; Lindl. and Gord. Journ. Hort. Soc. v. 214; Knight, Syn. Conif. 34; Gaud. Fl. Helv. vi. 186; Host, Synops. 523; Fl. Austr. ii. 629; Carr. Man. des Pl. iv. 340; Wahlenb. Fl. Carpat. 309; Baumg. Fl. Transylv. ii. 304; Pall. Fl. Ross. i. 3, t. 2; Ledeb. Fl. Alt. iv. 200; Carr. Tr. Gén. des Conif. 295, 387; Gord. Pinet. 219, 295; Beissn. Nadelh. 276; Henk. and Hochst. Syn. der Nadelh. 122; Maximon, Fruit. Fl. Amur. 262. *P. montana*, Lam. Fl. Franc. iii. 651 (not Mill. and Dur.). *P. foliis quinis*, &c. Gmel. Fl. Sib. i. 179; Duham. Arb. ii. 127; Hall. Helv. N. 1659; Du Roi, Harbk. ed. Pott. iv. 29. *P. silvestris*, &c. Bauh. Pin. 491.

P. sativa, Amman, Ruth. 178. *P. silvestris Cembro*, Cam. Epit. 42. *Larix sempervirens*, &c. Breyn. in Act. Nat. Cur. Cent. 7, 8. *Pinaster*, Bell. Conif. 20, 21. *Tæda arbor, Cembro Italicorum*, Daleh. Hist. i. 47. *Cembra sativa*, A. S. Oersted, Frilands-Trövösten i Danmark, 1864, 82. *P. Cembra stricta*, hort. *P. Aphernousli*, Hort. Angl.

Habitat.—On the Alps, at an elevation of from 4,200 to 6,700 feet, and on the Carpathian Mountains at the same elevations.

It was introduced into England by Archibald, Duke of Argyll, in 1746; but whether from Siberia or Switzerland is uncertain, though in all probability from the latter country, as the cones of the original tree, still existing at Whitton, answer better to the description of those of *P. C. helvetica* than to those of *P. C. sibirica*. The Swiss variety was strongly recommended by the Rev. J. Harte in his "Essays on Husbandry," published in 1746, and it is not improbable that it was he who communicated the seeds to the Duke of Argyll, though there is no positive evidence on the subject. Mr. Lambert states that a great many seeds were brought from Switzerland to England about the end of the last century, and that more than two thousand plants were raised from part of them.

The wood of *P. Cembra* is very soft, and its grain is so fine that it is scarcely perceptible. According to the "Nouveau Duhamel," it is very resinous, which is the cause of its agreeable fragrance. It is not commonly large enough to be used in carpentry, but in joinery it is of great value, as it is remarkably easy to work, and is of great durability. In Switzerland it is very much used by turners, and the shepherds of the Swiss cantons and of the Tyrol occupy their leisure hours in carving out of it numerous curious little figures of men and animals, which they sell in the towns, and which have found their way all over Europe. The wood is much used for wainscoting; having not only an agreeable light brown appearance, but retaining its odour, according to Kasthofer, for centuries. In Dauphiné the kernels of the seed, Villars informs us, are eagerly sought after by a species of crow (*Corvus Caryocatactes*, L.), which shows an almost incredible degree of skill in breaking the hardest shells. In Switzerland the seeds are used in some places as food, and in others as an article of luxury; and the shell being very hard, and requiring some time and skill to separate it from the kernel, the doing so forms an amusement for young persons in the long winter evenings, who, Kasthofer observes, show a degree of skill in it that might vie with that of the squirrel. In some places in the Tyrol the seeds are bruised, and an oil obtained from them by expression. So abundant is this oil in comparison with that produced by other seeds, that while a pound of flax seed yields only 2½ oz., 1 lb. of cembra seed yields 5 oz. Cembra oil is used both as food and for burning in lamps; but as the breaking of the seeds requires a long time, it is generally dearer than most other oils. It has a very agreeable flavour when newly made, but very

soon becomes rancid. The shells of the kernels, steeped in any kind of spirits, yield a fine red colour (Loudon, "Arboretum et Fruticetum Britannicum," 1844, iv. 2278).

P. Cembra has in Danish parks and forests attained a height of about 70 feet. One specimen, planted in 1845, is now 42 feet high and 3 feet 2 inches in girth; and another, also recently measured, planted in 1864, 30 feet high and 3 feet in girth. Cones often ripen in Denmark.

P. Cembra grows very well in Southern and Middle Sweden, and in the vicinity of Stockholm. It grows more than a foot a year. It even grows well in Angermanland and South Norbotten at about 64°. It grows also at Wiborg (60° 45'), in Finland.

P. C. sibirica, Loud. When travelling in Russia I discovered that the seeds of this variety were much liked, and that they were exported to parts of Scandinavia, where they are called "Russer-nödder," that is, Russian nuts. The Russian farmers often do much harm to the few and very scattered forests of this tree, as they do not hesitate to cut down trees merely for the sake of collecting the seeds.

Habitat.—Eastern Russia, and in Siberia. In Russia the border-line for its distribution forms a half-circle whose convexity turns to the west. The south border is on the west of Ural, in the northern part of the government of Perm, about 59° (or perhaps already at Jekaterinbourg, 56½°—Eversmann). Farther to the west the border-line goes into the government of Wiaetka (58°), and from there NNW. to Solwytshchegodsk (61½°), where it reaches its most western point. It further goes, first NE. and afterwards right E., to Ural, where it reaches its most northern point, at 64½° (A. E. v. Baer and Gr. v. Helmeisen, "Beiträge zur Kenntniss des Russischen Reiches," xviii. 17, Petersbourg, 1856). Schrenck says ("Reise in den Nordosten," &c. p. 30) that the *Cembra* Pine has been found at the Petschora River (about 66°), in the government of Archangel. In the southern part of the Jenesei Valley (59½°) it is recorded that the *Cembra* Pine (the Siberian form) here and there grows in forests without any other trees (Ath. v. Middendorf, "Reise in den äussersten Norden und Osten Sibiriens," iv. 557). Farther to the north it is more and more spread amongst other trees. Near Krasnojarsk (56° 1') and Jeneseisk (58° 27') the *Cembra* Pine and the Larch (*Larix sibirica*) also grow to gigantic dimensions. The *Cembra* Pine is said to reach a height of over 200 feet (62·7 mètres), and to attain at the base a diameter of 6 feet (1·8 mètre). It reaches its northern limit at Palavinskoj (69° 10'). ("Bihang til Kgl. Svenska Vetenskaps Academiens Handlingar," vol. iv. No. 11, pp. 41, 42; and Chr. Ed. Otto, "Hamburger Garten- und Blumenzeitung," 1877, p. 205.)

The above notes on the distribution of this interesting Pine are taken from Professor F. C. Schübeler's "Viridarium Norvegicum," 1886, i. 389.

I have cones of different sizes of this Pine, and I think there exist several varieties of it.

P. cembroides, Zucc. in Flora, 1832 ; Gord. Journ. Hort. Soc. i. 236 (*cum ic.*) ; Fl. Serr. iv. 324, 325, 331, f. 97 ; Lindl. and Gord. Journ. Hort. Soc. v. 216 ; Carr. Tr. Gén. Conif. 404 ; Gord. Pinet. 192 ; J. E. Nelson, Pinac. 107. *P. edulis*, Wislitz. in Mem. of a Tour in Northern Mexico, 1846-47, 88 ; Lindl. and Gord. Journ. Hort. Soc. v. 216 ; Carr. Rev. Hort. 1854, 227, and Tr. Gén. Conif. 408. *P. fertilis*, Roezl, ex Gord. Pinet. suppl. 76.

Habitat.—Santa Catalina Mountains, Arizona (Pringle) ; through Northern Mexico, near Real del Monte.

A small tree, in Arizona 20-25 feet in height, with a trunk hardly exceeding a foot in diameter ; dry ridges and slopes at an elevation of 3,500 feet. Also in South California.

Introduced by Hartweg in 1846.

May not be hardy.

P. clausa, Vasey in Mayr, Die Waldungen von Nordamerika, 116. *P. inops* var. *clausa*, Chapman.

Habitat.—Florida, shores of Pensacola Bay, south, generally within 30 miles of the coast, to Pease Creek, and occupying a narrow ridge along the east coast south of St. Augustine.

A tree 70-80 feet in height, with a trunk 2-2½ feet in diameter, or on the west coast rarely 20-30 feet in height ; barren, sandy dunes and ridges ; most common, and reaching its greatest development, about the head of Halifax Bay.

Wood light, soft, not strong, brittle ; bands of small summer cells broad, very resinous, conspicuous, resin passages numerous, prominent ; medullary rays numerous, thin ; colour light orange or yellow, the thick sapwood nearly white ; specific gravity, 0.5576 ; ash, 0.31 ; occasionally used for the masts of small vessels (C. S. Sargent).

This species may not yet be introduced into the northern parts of Europe. I possess typical cones of it in my collection.

P. contorta, Dougl. in Loud. Encycl. of Trees, 975, f. 1814-15 ; Loud. Arbor. iv. 2292, f. 2210-11 ; Nutt. Sylv. iii. 117, and ed. 2, ii. 176 ; Endl. Syn. Conif. 168 ; Carr. Tr. Conif. 364, and ed. 2, 474 ; Torr. in Pacific R.R. Rep. iv. 141 ; Gord. Pinet. 165, and ed. 2, 232 ; Cooper in Smithsonian Rep. 1858, 261 ; Lyall in Journ. Linn. Soc. vii. 133, 141, in part ; Henk. and Hochst. Nadelh. 24 ; Rothrock in Smithsonian Rep. 1867, 433 ; Hoopes, Evergreens, 81, in part ; Parl. in DC. Prodr. xvi. 2, 381, in part ; Watson in King's Rep. v. 330 ; Fowler in Lond. Gard. Chron. 1872, 1070 ; Gray in Proc. Am. Acad. vii. 402 ; Koch, Dendrol. ii. 301 ; Vasey, Cat. Forest Trees, 29 ; Hall in Coulter's Bot. Gaz. ii. 91 ; Macoun in Geolog. Rep. Canada, 1875-76, 211 ; Engelm. in Trans. St. Louis Acad. iv. 182, and Bot. Calif. ii. 126 ; Lond. Gard. Chron. 1883, 351 ; G. M. Dawson in Canadian Nat. ser. 2, ix. 327, in part ; Veitch,

Man. Conif. 145; Masters in Lond. Gard. Chron. 1883, 45, f. 5; Beissn. Nadelh. 219. *P. inops*, Bong. Vég. Sitch. 45. *P. Bolanderi*, Parl. in DC. Prodr. xvi. 2, 379. *P. Banksiana*, ex Lindl. and Gord. Journ. Hort. Soc. v. 218 (not Lambert). *P. MacIntoshiana*, Laws. ex Gord. Pinet. 165. *P. Boursieri*, Revue Hort. 1854, 225 (*cum ic.*).

Habitat.—Alaska, south along the coast to Mendocino County, California, extending inland to the western slopes of the coast ranges.

A small stunted tree, 20–30 feet in height, with a trunk 1–2 feet in diameter; sandy dunes and exposed rocky points.

Wood light, hard, strong, brittle, coarse-grained; bands of small summer cells very broad, resinous, conspicuous, resin passages numerous, not large; medullary rays numerous, obscure; colour light brown tinged with red, the thick sapwood nearly white; specific gravity, 0.5815; ash, 0.19 (C. S. Sargent, "Forest Trees of North America").

A specimen of *Pinus contorta* planted in 1876, now in a Danish garden, is 17 feet high with a girth of 1 foot 6 inches. Hardy.

P. Coulteri, Don in Linnæa, xvii. 440; Loud. Arbor. iv. 2250, f. 2144–47; Forb. Pinet. Wob. 67, t. 25, 26; Ant. Conif. 31, t. 12, 13; Penn. Cycl. xvii. 172; Link in Linnæa, xv. 510; Hook. and Arnott, Bot. Beechey, 393; Nutt. Sylv. iii. 112, and ed. 2, ii. 171; Endl. Syn. Conif. 160; Carr. in Fl. des Serr. ix. 275 and t.; Carr. Tr. Conif. 335, and ed. 2, 435; Cooper in Smithsonian Rep. 1858, 261; Torr. in Ives' Rep. 28; Henk. and Hochst. Syn. der Nadelh. 76; Bolander in Proc. Calif. Acad. iii. 218; Parl. in DC. Prodr. xvi. 2, 392; Vasey, Cat. Forest Trees, 31; Gord. Pinet. ed. 2, 266; Engelm. in Trans. St. Louis Acad. iv. 182, and Bot. Calif. ii. 127; Dawson, Pinet. Brit. i. 23, f. 1–5; Beissn. Nadelh. 257. *P. macrocarpa*, Lindl. in Bot. Reg. 1840, app. 61; Nelson, Pinac. 117.

Habitat.—California, Monte Diabla, south through the coast ranges to the Cuyamaca Mountains, and probably in Lower California.

A tree 80–150 feet in height, with a trunk 3–6 feet in diameter; dry ridges and slopes between 3,000 and 6,000 feet elevation; most common, and reaching its greatest development, in the San Jacinto Mountains.

Wood light, soft, not strong, brittle, coarse-grained; bands of small summer cells broad, very resinous, conspicuous, resin passages few, large; medullary rays numerous, prominent; colour light red, the thick sapwood nearly white; specific gravity, 0.4133; ash, 0.37 (C. S. Sargent).

Seems to be hardy.

P. deflexa, Torr. Rep. on the U.S. and Mexican Boundary, by W. H. Emory, 1859, ii. 209; Henk. and Hochst. Syn. der Nadelh. 416.

Habitat.—On the Cordilleras in California (Parry).

If our plant is correctly named, it is perhaps not quite hardy in Denmark,

P. densiflora, Sieb. and Zucc. *P. rubra*, Sieb. *P. japonica*, Forb. *P. Pinea*, Gord.

Habitat.—Japan. Common in the islands of Nippon and Kiusiu, on the mountains. It grows as far as to South-western Eso and Sikok.

Introduced into Europe by Siebold & Co., of Leyden, in 1854.

As far as I know we have only small plants in Denmark. I have seen a plant that had commenced to bear cones in South Sweden, but it was killed by the frost. Our young plants look well.

P. Devoniana, Lindl. Bot. Reg. 1839, app. 62; Spach, Hist. Vég. Phan. xi. 402; Loud. Encycl. of Trees, 1001, f. 1877-78; Endl. Syn. Conif. 153; Knight, Syn. Conif. 33; Lindl. and Gord. Journ. Hort. Soc. v. 215; Carr. Man. des Pl. 349, and Tr. Gén. Conif. 315; Gord. Pinet. 221; Henk. and Hochst. Syn. der Nadelh. 103 (excl. syn. Roezl); Nelson, Pinac. 111.

In Roezl's Catalogue, 1857-58, it is called *Pinus blanco*, *P. magnifica*, *P. Ocampi*, *P. Ocampi Deconiana*, *P. Thibaudiana*, and *P. Zitacuaria*.

Habitat.—Mexico. Hartweg found this at Ocotillo, between Real del Monte and Regia, on the most elevated points of the mountains.

It has been tried out of doors, but is not hardy in Denmark. I possess cones of it in my collection.

P. edulis, Engelm. in Wisliz. Mem. 88; Lindl. and Gord. Journ. Hort. Soc. v. 216; Revue Hort. 1854, 227.

Habitat.—New Mexico, between Cimaron and Santa Fé, in great numbers; also in Arizona. Dr. Mayr says its habitat is as far south as Pike's Peak, in Colorado, on dry, stony soil. In Colorado it will ascend as high as 8,400 feet. He calls it "an upright dwarf Pine."

Introduced into Europe in 1848.

A small tree, 20-30 feet in height, with a trunk 1-3 feet in diameter; dry mesas and slopes, generally on lime or sandstone, reaching in Colorado an elevation of 9,000 feet (C. S. Sargent).

Very likely not hardy.

P. Elliotti, Engelmann. Does not seem to be hardy.

P. excelsa, Wall. Mss. Pl. As. Rar. t. 201; Don in Lamb. Pinet. ed. 2, i. 55, t. 33; Wall. List. n. 6059; Forb. (Jam.) Pinet. Wob. 75, t. 29; Loud. Arbor. Brit. iv. 2285, f. 2197-2202, and Encycl. of Trees, 1022, f. 1915-18; Link in Linnæa, xv. 515; Spach, Hist. Nat. Vég. Phan. xi. 396; Ant. Conif. 42, t. 29, f. 1; Hoffmeister in Bot. Zeit. 1846, 184; Endl. Syn. Conif. 145; Knight, Syn. Conif. 34; Lindl. and Gord. Journ. Hort. Soc. v. 215; Carr. Tr. Gén. des Conif. 300; Gord. Pinet. 222; Henk. and Hochst. Syn. 90; Beissn. Nadelh. 283. *P. Strobilus*, Hamilt. Account of Nepaul, 83 (not L. nor Thunb.). *P. pendula*, Griff. Journ. of Travels, 211, 237, &c. *P. Chylla*, Lodd. Cat. 1836, 50. *P. Strobilus excelsa*, Loud. Encycl. of Trees, 1022, f. 1915-18. *P. Strobilus argentea*, hort. *P. Strobilus pendula*, hort. *P. nepalensis*, De Chambr. Tr. Prat. Arb.

Résin. 312. *P. Dicksoni*, hort. *Strobis excelsa*, A. S. Oersted, Frilands-Trövöxten i Danmark, 1864, 80.

Habitat.—The Himalayas, from Bhotan to Afghanistan, at elevations ranging from 5,000 to 12,000 feet.

The first author who drew attention to this species was Dr. Francis Hamilton, who gathered it in 1802 near Narainhetty, and noticed it in his "Account of Nepaul" under the name of *Pinus Strobis*, from which he did not separate it. Dr. Wallich next determined its characters, and named it *P. excelsa*. He brought home many good specimens in various states, some of which he placed in the hands of Mr. Lambert, who published it as a new species in the second edition of his "Genus Pinus" under the name given to it by Dr. Wallich, and the remainder are still in his collection in the possession of the Linnean Society. Since then its history is almost confined to the discovery of additional localities and the ascertainment of its geographical range. It was introduced into Britain by Dr. Wallich about 1827 ("Pinetum Britannicum").

The specific name *excelsa*, "lofty," refers, according to Major Madden, not to the stature of the tree, but to the elevation at which it is found.

It is one of the most common Pines of the central zone throughout the whole Himalayas. Dr. Griffith states its most eastern limits to be Bhotan, where it is called "Lumshing," "Lamshing," or "Lemshing;" and its most western locality to be on the mountains of Kafirstan, near Jalalabad, where it is called "Piunee." It has not hitherto been met with in Sikkim, and appears to be wholly wanting in Central and North-west Kamaon, but is the uppermost and only Pine met with in the ascent to the Neetee Pass in Gurwhal, at an elevation of 11,000 feet, and on both the north and south faces of the Lamakaga Passes; while, according to Captain Gerard, its highest limit on the snowy range of Leem is at an elevation of 12,000 feet, and its lowest, near Deorah, in Joobul, at only 5,000 feet, thus fixing the extreme limits of *Pinus excelsa* at from 5,000 to 12,000 feet of elevation. Again, Mr. Winterbotham traced it to the mountains of Gilgit, beyond Cashmere, its most northern habitat hitherto ascertained, as Bhotan is its most southern and Jalalabad its most western limits.

This is the "Kail," or "Kaell" (sort of Pine), of the hill people about Simla, the "Lem" of Kunawur, and the "Yari" of Cashmere; also the Weeping Fir of the Himalayan travellers, and the "Chylla," or "Cheel," of Kamaon and Gurwhal.

Timber soft, white, and remarkably compact, producing in great abundance a highly fragrant resinous turpentine.

Dr. Wallich and some other travellers mention what they consider varieties of this Pine, some with shorter, others with greener leaves, and others with stiffer foliage, but all such varieties no doubt arise from climate and elevation.

This tree flowers about the end of May, and the cones require eighteen months to mature (G. Gordon, "The Pinetum," 1875).

This elegant Pine grows from 90 to 100 feet high in its native country, where the timber is in much repute. In Scotland it is found in most collections, and forms a handsome ornamental tree when growing in a light warm soil and sheltered site. It does not thrive in cold damp soils, and bears exposure indifferently. The long slender branches, gracefully clothed with bluish-green glaucous leaves, contrast pleasantly with those of other darker-foliaged trees. The tree is full of clear limpid turpentine, which flows from the slightest incision of the bark (Trans. Roy. Scot. Arb. Soc. vol. xii. part 2).

A specimen of *Pinus excelsa*, planted in 1870, when measured lately showed a height of 20 feet and a circumference of the stem of 3 feet. Larger plants, not so old, have been seen in Denmark, but some of them are not so vigorous. I possess cones ripened in Denmark.

Pinus excelsa has, Prof. Schübeler says, done well for several years in the Botanic Gardens at Christiania. It is also to be found here and there as far north as Stockholm.

P. e. longifolia. Seems to be hardy.

P. filifolia, Lindl. Bot. Reg. 1840, app. 61; Loud. Encycl. of Trees, 1008, f. 1889-90; Spach, Hist. Vég. Phan. xi. 403; Endl. Syn. Conif. 155; Knight, Syn. Conif. 33; Lindl. and Gord. Journ. Hort. Soc. v. 216; Carr. Man. des Pl. iv. 350, and Tr. Gén. Conif. 320; Gord. Pinet. 223; Henk. and Hochst. Syn. der Nadelh. 102 (excl. syn.); J. E. Nelson, Pinac. 112. *P. Skinneri*, Forb. ex Gord.

About a dozen of the names in Roezl's Catalogue (1857-58) might be referred to this species.

Habitat.—Guatemala. Hartweg saw it near Santiago, on the Vulcan del Fuego, and on the mountains near the town of Guatemala.

Introduced into Europe in 1840.

I have only cones of this species.

P. flexilis, Wislizenus. Long's Exped. ii. 27, 34; Torr. in Ann. Lyc. N. York, ii. 249, and Pacific R.R. Rep. iv. 141; Eaton, Manual, ed. 6, 265; Eaton and Wright, Bot. 359; Nutt. Sylv. iii. 107, t. 112, and ed. 2, ii. 167, t. 107; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 220; Carr. in Fl. des Serres, ix. 200, Rev. Hort. 1854, 228, and Tr. Gén. Conif. 310, ed. 2, 392; Bigelow in Pacific R.R. Rep. iv. 6, 20; Gord. Pinet. 224, and ed. 2, 302; Cooper in Smithsonian Rep. 1858, 262; Parry in Trans. St. Louis Acad. ii. 121; Engelm. in Am. Journ. Sc. ser. 2, xxxiv. 331, Trans. St. Louis Acad. ii. 208, Wheeler's Rep. vi. 257, and Bot. Calif. ii. 124; Henk. and Hochst. Syn. der Nadelh. 126; Nelson, Pinac. 112; Bolander in Proc. Calif. Acad. iii. 318; Hoopes, Evergreens, 131, f. 18; Parl. in DC. Prodr. xvi. 2, 403; Porter in Hayden's Rep. 1871, 494; Watson in King's Rep. xxviii. 332, and Pl. Wheeler, 17; Rothrock,

Pl. Wheeler, 27, 50, and Wheeler's Rep. vi. 9; Porter and Coulter, Fl. Colorado; Hayden, Surv. Misc. Pub. No. 4, 130; Murray in Lond. Gard. Chron. 1875, 106; Vasey, Cat. Forest Trees, 32; Sargent in Am. Journ. Sc. ser. 3, xvii. 420; Lawson, Pinet. Brit. i. 35, f. 1. *P. Lambertiana* β *brevifolia*, Hook. ex Nutt. l. c.

Habitat.—New Mexico and California. Jeffrey found it on the mountain tops near Fort Hope, near the Fraser River on the Shasta Mountains, at an elevation of more than 6,500 feet, but it ascends much higher.

May be hardy.

P. Fremontiana, Endl. May prove to be the same as *Pinus monophylla*. Seems to be hardy.

Habitat.—Eastern slopes of the Rocky Mountains, Montana, and probably much farther north; south to New Mexico, on the Guadalupe and Limpia Mountains, Western Texas (Havard); on the high mountain ranges of Utah, Nevada, and Northern Arizona, Inyo Mountains, and Mount Silliman, California.

A tree 50–60 feet in height, with a trunk 2–4 feet in diameter; dry, gravelly slopes and ridges between 4,000 and 10,000 feet elevation; common along the eastern slopes of the Rocky Mountains of Northern Montana, forming open, scattered forests; here low, round-topped, and the prevailing forest tree; in Central Nevada the most valuable lumber tree of the region (C. S. Sargent).

P. Gerardiana, Wall. Mss.; Lamb. Pin. ed. 3, t. 79; Royle, Himalay. 32, t. 85, f. 2; Loud. Arbor. Brit. iv. 2254, f. 2153–55, and Encycl. of Trees, 998, f. 1869–70; Pinet. Wob. 53, t. 19; Ant. Conif. 29, t. 10; Hoffmeister in Bot. Zeit. 1846, 184; Spach, Hist. Vég. Phan. xi. 390; Endl. Syn. Conif. 159; Lindl. and Gord. Journ. Hort. Soc. v. 216; Knight, Syn. Conif. 30; Carr. Traité Gén. des Conif. 333; Gord. Pinet. 195. *P. Neosa*, Govan, Mss. *P. Chalybosa*, Elph. ex Knight, l. c.; Loud. Encycl. of Trees, 1118. *P. Aucklandii*, Lodd. Cat.

Habitat.—The Himalayas, from Afghanistan to Nepaul, at elevations between 8,000 and 10,000 feet.

Introduced into Europe about the year 1820.

Seems to be hardy.

A tree growing 50 feet high, with a compact head, found in great abundance, forming large forests on the northern side of the snowy range of mountains in Kunamur, beyond the influence of the periodical rains, where it grows in very dry, rocky ground; and, according to Major Madden, its manner of growth differs from that of any of the other Pines of India. Its trunk is of large girth, but scarcely exceeding 50 feet in height, furnished with numerous horizontal branches nearly to the ground, the upper ones forming a large, compact, conical head. It is also found to the north of Cashmere, and on the Astor Mountains in Little Thibet. The mountains near

Nijrow, in the Kohistan of Cabul, are also covered with the Chilghoza Pine. Captain Gerard states its highest limits on the Inner Himalayas to be from 10,000 to 12,000 feet of elevation. The exterior bark is of a silvery grey, falling off in large flakes, and never transforming itself into the rough outer coating like the other Pines. It is called "Rhee" or "Ree" in Kunamur, "Shungtee" by the Thibetans, and "Sonoubar Sukkar" (sweet pine-nut) by the Persians and Arabs.

The Shipkees in Thibet call this Pine "Kuminche" and "Sunoubur-Sughar" (lesser sweet-nut pine), an apt name enough, for the tree seldom grows more than 50 feet high. Mr. Winterbotham found it as far north as Gilgit; but neither Dr. Hooker nor Dr. Griffith ever seem to have discovered it in a native state either in Eastern Nepaul or Sikkin; and Captain Gerard states its highest altitude on the southern exposures of the Inner Himalayas to be from 10,850 to 12,300 feet—generally associated with *Cedrus Deodara*. Dr. Griffith found it in Afghanistan occurring on the outer ranges, indicating exemption from the periodical rains. It is styled by Europeans "the edible pine-nut," the seeds being nearly an inch long, very sweet, and said to possess many good qualities, but amongst them that of easy digestion is certainly not to be reckoned as one.

The Neoza Pine also affords abundance of fine turpentine, and the cones exude a copious white resin, and produce about 100 seeds each, which are sold in the Simla bazaars under the name of "Neoza" nuts, and in those of Afghanistan as "Chilghoza" nuts.

It is quite hardy in England, but very slow in growth (G. Gordon, "The Pinetum," 1875).

Dr. Aitchison (Journ. Linn. Soc. Nos. 106, 107) thus describes *Pinus Gerardiana* as seen in the Kuram district in Afghanistan: "A very handsome tree that does not branch as Pines usually do, the trunk and branches being more like those of a well-formed Oak. It is easily recognised at a distance by its nearly white, ash-grey bark, which on close examination is seen not to be of one colour, but consists of patches of all tints, from light green to autumnal reds and browns; this is due to the peculiar way the bark exfoliates. The nuts form a large article of diet amongst the villagers of the district in which the Pine grows, and are esteemed a luxury in North-west India."

Named by Dr. Wallich in compliment to its discoverer, Capt. Gerard, an officer in the Bengal Native Infantry.

Seems to be hardy in Denmark.

P. halepensis, Mill. Dict. n. 8, ic. t. 216; Lamb. Pinet, ed. 1, 15, t. 11, and ed. 2, i. 18, t. 7; Willd. Baumz. 267; Desf. Hist. Arbr. ii. 611; Forb. (Jam.) Pinet. Wob. 25, t. 8; Link in Linnæa, xv. 496; Loisel. Nouv. Duham. v. 238, t. 70; Griseb. Spicileg. Fl. Rumel. ii. 348; DC. Fl. Fr. 274; Spach, Hist. Vég. Phan. xi. 383; Schouw, Ann. Sc. Nat. ser. 3, iii. 237; Loud. Encycl. of Trees,

967, f. 1790-93; Ant. Conif. 2, t. 1, f. 3; Endl. Syn. Conif. 180; Lindl. and Gord. Journ. Hort. Soc. v. 219; Knight, ¹Syn. Conif. 27; Carr. Tr. Gén. Conif. 393; Gord. Pinet. 165; ²Henk. and Hochst. Syn. der Nadelh. 55; Hoopes, Evergreens, 83; Nelson, Pinac. 113; Beissn. Nadelh. 323. *P. genuensis*, Cook. *P. hierosolimitana*, Duham. Arbr. ii. 126, n. 14.

Habitat.—The Mediterranean region, from Portugal, Spain, and South-east France to the Levant; also Western Asia as far as Georgia, and even Persia; on Mount Hebron in Palestine, and other parts of Syria (Carr. 506).

Introduced into England in 1763 by Bishop Compton.

Is perhaps not quite hardy, although a young plant stood the winter of 1890-91 out of doors.

P. h. Pithyusa, Stev. ex Gord. Pinet. 166. *P. Pithyusa*, Strangw. in Gard. Mag. xvi. 638. *P. maritima*, Lamb. Pinet. ed. 2, i. 13, t. 6. *P. abchasica*, Fisch. ex Gord. Pinet. 166. *P. abasica*, Carr. Conif. ed. 1, 352. *P. halepensis abasica*, Carr. Conif. ed. 2, 507. *P. arabica*, Sieber ex Spreng. Syst. iii. 886. *P. colchica*, hort.

Hardiness doubtful.

P. Hartwegii, Lindl. Bot. Reg. 1839, app. 62; Spach, Hist. Vég. Phan. xi. 402; Loud. Encycl. of Trees, 1000, figs. 1875-76; Endl. Syn. Conif. 152; Lindl. and Gord. Journ. Hort. Soc. v. 215; Knight, Syn. Conif. 83; Carr. Man. des Pl. 348, and Tr. Gén. Conif. 311; Gord. Pinet. 226 (excl. syn. Roezl); Henk. and Hochst. Syn. der Nadelh. 107 (excl. syn. Roezl); J. E. Nelson, Pinac. 113; Hoopes, Evergreens, 146.

Introduced into Europe in 1839.

Habitat.—Mexico. Hartweg discovered it on the Campanario Mountains at an elevation of about 10,000 feet; it is to be found there even where the "Oyamel" (*Abies religiosa*) disappears. Further, this Pine is found on the mountains of Orizaba and near Real del Monte, and there the tree attains a height of 100 feet.

As far as I know it has not yet been cultivated in Denmark. I have cones in my collection.

P. inops, Sol. ex Ait. Hort. Kew. iii. 367, and ed. 2, v. 316; Michx. Fl. Bor. Am. ii. 204; Lamb. Pin. ed. 1, i. 18, t. 13, ed. 2, i. 21, t. 14, and ed. 3, i. 25, t. 12; Willd. Spec. iv. 496, Enum. 988, and Berl. Baumz. 266; Pers. Syn. ii. 578; Michx. f. Hist. Arb. Am. i. 58, t. 4; N. Amer. Sylv. ed. 3, iii. 103, t. 139; Nouv. Duham. v. 236, t. 69, f. 1; Pursh, Fl. Am. Sept. ii. 641; Smith in Rees' Cycl. xxviii. No. 10; Barton, Prodr. Fl. Philadelph. 93; Compend. Fl. Philadelph. ii. 183; Nutt. Gen. ii. 223; Hayne, Dend. Fl. 173; Elliott, Sk. ii. 633; Spreng. Syst. ii. 886; Torr. Compend. Fl. N. States, 359; Audubon, Birds, t. 97; Beech. Bot. 338; Eaton, Manual, ed. 6, 265; Bon. Jard. 1837, 376; Loud. Arbor. iv. 2192, f. 2068-71; Forb. Pinet. Wob. xv. t. 4; Hook. Fl. Bor. Am. ii.

161, in part; Eaton and Wright, Bot. 358; Ant. Conif. 17, t. 5, f. 3; Lindl. in Penn. Cycl. xvii. 171; Link in Linnæa, xv. 500; Spach, Hist. Vég. Phan. xi. 386; Endl. Syn. Conif. 167; Knight, Syn. Conif. 26; Lindl. and Gord. in Journ. Hort. Soc. v. 217; Carr. Tr. Gén. Conif. 361, and ed. 2, 471; Darlington, Fl. Cestrica, ed. 3, 290; Darby, Bot. S. States, 514; Gord. Pinet. 167, and ed. 2, 238; Cooper in Smithsonian Rep. 1858, 257; Chapman, Fl. S. States, 433; Curtis in Rep. Geolog. Surv. N. Carolina, 1860, iii. 20; Wood, Cl. Book, 661, and Bot. and Fl. 313; Henk. and Hochst. Nadelh. 22; Nelson, Pinac. 113; Gray, Man. N. States, ed. 5, 470; Hoopes, Evergreens, 84; Parl. in DC. Prodr. xvi. 2, 380 (excl. syn. *variabilis*); Vasey, Cat. Forest Trees, 30; Veitch, Man. Conif. 158. *P. virginiana*, Mill. Dict. n. 9. *P. variabilis*, Lamb. Pin. ed. 1, 22, t. 15.

Habitat.—Middle Island, Long Island, Tottenville and Clifton, Staten Island, New York; south, generally near the coast, to the valley of the Savannah River (Aiken, South Carolina), and through Eastern and Middle Kentucky to “The Knobs” of South-eastern Indiana.

A tree 80–120 feet in height, with a trunk 2–3 feet in diameter, or in the Atlantic States generally much smaller; sandy, generally barren soil, reaching its greatest development west of the Alleghany Mountains (C. S. Sargent).

This Pine is found very abundantly in many of the interior States, and especially where the soil is of a poor, sandy character. In such situations it grows from 15 to 30 feet high. In the barren districts of New Jersey particularly, *P. inops* covers large tracts of land known as “pine barrens.” Some of the trees even in these waste places are quite handsome, being remarkable for the pale yellowish twigs and leaves. Many examples of large trees, conical in shape, are to be met with, although the large majority are but small, stunted shrubs, and far from ornamental. This species presents a peculiar and striking appearance; the straggling branches are covered with a dark, rough bark, and the young shoots are beautifully tinged with violet, while the entire tree is almost covered with exuding resin, which emits a pleasant fragrance or balsamic odour (Hoopes, “Evergreens”).

Hardy.

P. insignis, Dougl. Mss. ex Loud. Arb. iv. 2265, f. 2170–72; Forb. Pinet. Wob. 51, t. 18; Lindl. in Penn. Cycl. xvii. 171; Ant. Conif. 27, t. 8, f. 1; Hook. and Arnott, Bot. Beechey, 393; Spach, Hist. Vég. Phan. xi. 389; Nutt. Sylv. iii. 115, and ed. 2, ii. 174; Bentham, Voy. “Sulphur,” 55; Endl. Syn. Conif. 163; Knight, Syn. Conif. 30; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 217; Carr. Tr. Conif. 339, and ed. 2, 440; Bigelow in Pacific R.R. Rep. iv. 25; Torr. in Pacific R.R. Rep. iv. 141; Bot. Mex. Boundary Survey, 209, t. 55; Ives’ Rep. 28; Newberry in Pacific R.R. Rep. vi. 96; Gord. Pinet. 197, and ed. 2, 270; Cooper in Smithsonian Rep. 1858, 21; Murray in Edinburgh New Phil. Journ. new ser. xi, 222

(Trans. Bot. Soc. Edin. vi. 347); Henk. and Hochst. Nadelh. 69; Bolander in Proc. Calif. Acad. iii. 262, t. 317; Nelson, Pinac. 114; Hoopes, Evergreens, 143; Parl. in DC. Prodr. xvi. 2, 395; Lawson, Pinet. Brit. i. 37, t. 1, 5, f. 1-14; Fowler in Lond. Gard. Chron. (1872), 1070; Vasey, Cat. Forest Trees, 31; Engelm. in Trans. St. Louis Acad. iv. 182, and Bot. Calif. ii. 128; Veitch, Man. Conif. 163. *P. californica*, Loisl. in Nouv. Duham. v. 243? (not Harw.). *P. adunca*, Bosc. Msc. ex Endl. *P. radiata*, Don in Linn. Trans. xvii. 442. *P. tuberculata*, Don in Linnæa, xvii. 442 (not Gord.). *P. montereyensis*. *P. monteragensis*, hort.

Habitat.—California, Pescadero to Monterey and San Simeon Bay.

A tree 80-100 feet in height, with a trunk 2-3 feet in diameter; sandy soil in immediate proximity to the sea-coast; rare and local; now widely cultivated on the Pacific coast for shelter and ornament. A form from Guadaloupe Island, off the coast of Lower California, with leaves in pairs, is var. *vinata* (Engelm. in Proc. Am. Acad. xi. 119, and Bot. Calif. ii. 128).

P. insignis, Dougl., is distinguished by its fresh green foliage and closely and strongly serrulate leaves. Cones generally thick and very oblique, with the scales of the outer side large and thick, and on the inner side smaller and flat; some cones are more regular, all the scales being nearly equally flat.

A young plant, somewhat covered in the winter time, has kept alive three years. Another not well covered died.

P. Jeffreyi, Murr. Rep. Oregon Exped. 2, t. 1; Edinburgh New Phil. Journ. new ser. xi. 224, t. 8, 9 (Trans. Bot. Soc. Edin. vi. 350, and t.); Carr. Tr. Gén. Conif. 358, and ed. 2, 439; Gord. Pinet, 198, and ed. 2, 272; Henk. and Hochst. Nadelh. 87; Nelson, Pinac. 115; Hoopes, Evergreens, 115; Parl. in DC. Prodr. xvi. 2, 393; Lawson, Pinet. Brit. i. 45, t. 6, f. 1-4; Koch, Dendr. ii. 314; Engelm. in Coulter's Bot. Gaz. vii. 4; Veitch, Man. Conif. 165; Beissner, Nadelholz. 263.

Habitat.—California, Scott's Mountain, Siskiyou County, south along the Sierra Nevada to the San Bernardino and San Jacinto Mountains.

A large tree 98-100 feet in height, with a trunk 4-13 feet in diameter; dry, gravelly slopes between 6,000 and 8,000 feet elevation; most common, and reaching its greatest development, on the eastern slope of the Sierra Nevadas, here generally replacing the allied *P. ponderosa*, from which it may be distinguished by its more deeply cleft bark, glaucous branchlets and leaves, much larger cones, and by the strong pungent odour of oil of orange of the freshly cut branchlets.

Wood light, strong, hard, rather coarse-grained, compact; bands of small summer cells not broad, very resinous, conspicuous; resin passages few, not large; medullary rays numerous, obscure; colour light red, the sapwood pale yellow or nearly white; specific gravity,

0·5206 ; ash, 0·26 ; largely manufactured into coarse lumber (C. S. Sargent, "Forest Trees of North America"). Abietine, a volatile carbo-hydrogen possessing powerful anæsthetic properties, is probably obtained by distilling the resinous exudation of this species and of *P. Sabiniana* (Watts' Dict. Chem. ed. 2, Suppl. 1 ; Am. Journ. Pharm. 1872, 97 ; U.S. Dispensatory, ed. 2, 1417, and ed. 14, 900 ; Flückiger and Hanbury, Pharmacographia, 545).

P. Jeffreyi, planted near Copenhagen in 1870, has lately given a measurement of 26½ feet in height and 2½ feet in girth. It has coned.

P. Jeffreyi is hardly tried anywhere in Norway save at the Botanic Gardens at Christiania, where a fifteen-year-old plant is to be found ; it is 6½ feet high (2·03 mètres). In Sweden this species thrives in the south, as well as at Stockholm. It also grows at St. Petersburg (Prof. F. C. Schübeler, "Viridarium Norvegicum," 1886, 390).

P. koraiensis, Sieb. and Zucc. Flor. Jap. ii. 28, t. 116. *P. Strobis*, Thunb. Fl. Jap. 275 (not L.). *P. mundschnurica*, Rupr. ex Regl. Tent. Fl. Uss. ; Mayr, Monog. Abiet. Jap. 1890, 73.

Habitat.—A tree growing from 30½ to 40 feet high, rarely found wild in China or Japan, but much cultivated in gardens, where it often does not exceed 12 or 14 feet in height. It is found growing along the sea-coast on the peninsula of Corea, and about the Bay of St. Peter and St. Paul in the Island of Koraginsk, where the seeds are eaten by the people.

By the Japanese it was for a long time regarded as lost, they believing that soldiers from the Corean wars had taken it with them. But when the large forests of Middle Japan were explored, it was found in the colder leaf-tree forests, and in the higher situated fir forests only in few instances, but a tree of first size. It was also found on the mountains of Katyuke. But although it is rare and new, it grows near the sea (Mayr).

The Japanese call it "Wummi-matsu" (Sea-coast Pine), and the Chinese name, "Hai-sung-tse," also means Maritime Pine (G. Gordon, "The Pinetum," 1875).

P. Lambertiana, Dougl. in Linn. Trans. xv. 500 ; Companion Bot. Mag. ii. 92, 106, 107, 130, and 152 ; Lamb. Pin. ed. 1, iii. 157, t. 68, 69 ; Loud. Arbor. iv. 2288, f. 2203 ; Forb. Pinet. Wob. 77, t. 30 ; Hooker, Fl. Bor. Am. ii. 161 ; Ant. Conif. 41, t. 19 ; Lindl. in Penn. Cycl. xvii. 173 ; Hook. and Arnott, Bot. Beechey, 394 ; Spach, Hist. Vég. Phan. xi. 397 ; Nutt. Sylv. iii. 122, t. 144, and ed. 2, ii. 180, t. 114 ; De Chambray, Tr. Arb. Rés. 346 ; Endl. Syn. Conif. 150 ; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 215 ; Carr. Tr. Gén. Conif. 307, and ed. 2, 403 ; Bigelow in Pacific R.R. Rep. iv. 21 ; Torr. in Pacific R.R. Rep. iv. 141 ; Bot. Mex. Boundary Survey, 210 ; Ives' Rep. 28 ; Newberry in Pacific R.R. Rep. vi. 42, 90, f. 14 ; Gord. Pinet. 228, and ed. 2, 307 ; Cooper in Smithsonian Rep. 1858, 262 ; Murray in Trans. Bot. Soc.

Edinburgh, vi. 369 ; Lawson, Pinet. Brit. i. 47, t. 7, f. 1-7 ; Bolander in Proc. Calif. Acad. iii. 226, 317 ; Henk. and Hochst. Nadelh., 95 ; Nelson, Pinac. 115 ; Hoopes, Evergreens, 134 ; Parl. in DC. Prodr. xvi. 2, 402 ; Fowler in Lond. Gard. Chron. (1872), 1071 ; Koch, Dendr. ii. 2, 323 ; Vasey, Cat. Forest Trees, 32 ; Veitch, Man. Conif. 179 ; Beissner, Nadelholz. 294.

Habitat.—Oregon, Cascade and coast ranges, from the head of the Mackenzie River and the valley of the Rogue River, south along the western flank of the Californian sierras, through the coast ranges to the Santa Lucia Mountains, and in the San Bernardino and Cuyamaca Mountains.

A large tree, 150-300 feet in height, with a trunk 10-22 feet in diameter ; most common, and reaching its greatest development, upon the sierras of Central and Northern California between 4,000 and 8,000 feet elevation ; in the Oregon coast ranges descending to 1,000 feet above the sea-level.

Wood very light, soft, coarse, straight-grained, compact, satiny, easily worked ; bands of small summer cells thin, resinous, conspicuous, resin passages numerous, very large and conspicuous ; medullary rays numerous, obscure ; colour light brown, the sapwood nearly white ; specific gravity, 0.3684 ; ash, 0.22 ; now largely manufactured into lumber and used for interior finish, door-blinds, sashes, &c., and for cooperage and woodenware ; less valuable and less easily worked than that of the eastern White Pine (*Pinus Strobus*) ; its quality injured by the larger and more numerous resin passages. A saccharine exudation from the stumps of cut or partially burnt trees is sometimes used as a substitute for sugar (Sargent).

For the discovery of this gigantic species we are indebted to the late indefatigable collector for the Royal Horticultural Society, Mr. David Douglas, who first found it on the western coast of North America. He has given an elaborate description of its growth, &c., in vol. xv. of the "Linnean Transactions," from which the following is an extract : "This plant covers large districts about a hundred miles from the ocean, in latitude 43° N., and extends as far to the south as 40°. It first came under my notice in August 1825 while at the head-waters of the Multnomah River. In October 1826 it was my good fortune to meet with it beyond a range of mountains running in a south-westerly direction from the Rocky Mountains towards the sea, and terminating at Cape Orford in Vancouver. It grows sparingly upon low hills, and the undulating country east of the range of mountains just mentioned. Where the soil consists entirely of pure sand, in appearance incapable of supporting vegetation, there it attains its greatest size and perfects its fruit in most abundance. The trunk grows from 150 to 200 feet in height, varying from 20 to near 60 feet in circumference. One specimen, which had been blown down by the wind (and this was certainly not the largest

I saw), was of the following dimensions: its entire length was 215 feet; its circumference, 3 feet from the ground, was 57 feet 9 inches; and, at 134 feet from the ground, 17 feet 5 inches. The trunk is unusually straight, and destitute of branches for about two-thirds of the height; the bark is uncommonly smooth for such large timber, of a light brown colour on the south, and bleached on the north side. The branches are rather pendulous, and form an open pyramidal head, with that appearance which is peculiar to the *Abies* tribe. The leaves are between 4 and 5 inches long, and grow in fives, with a short sheath like those of *P. Strobus*; they are rigid, of a bright green colour, but not glossy, and, from minute denticulations of the margins, are scabrous to the touch. The cones are pendulous from the extremities of the branches; they are two years in acquiring their full growth, are at first upright, and do not begin to droop, I believe, till the second year; when young they have a very taper figure; when ripe they are about 11 inches in circumference at the thickest part, and vary from 12 to 16 inches in length. The scales are lax, rounded at the apex, and perfectly destitute of spines. The seeds are large, eight lines long and four broad, oval, and, like those of *P. Pinea*, their kernels are sweet and very pleasant to the taste. The wing is membranaceous, of a dolabriform figure and fuliginous colour, about twice as long as the seed; it has an innumerable quantity of minute sinuous vessels, filled with a crimson substance, and forming a most beautiful microscopic object. The embryo has twelve or thirteen cotyledons. The whole tree produces an abundance of pure amber-coloured resin. The timber is white, soft, and light; it abounds in turpentine reservoirs, and its specific gravity has been ascertained, by a specimen brought home by me, to be 0.464. The annual layers are very narrow. In the above specimen there were fifty-six in the space of $4\frac{1}{2}$ inches next the outside. The resin, which exudes from the trees when they are partly burned, loses its usual flavour and acquires a sweet taste, in which state it is used by the natives as sugar, being mixed with their food. The seeds are eaten roasted, or are pounded into coarse cakes for their winter store. The species to which this Pine is most nearly allied is undoubtedly *P. Strobus*, from which, however, it is extremely different in station, habit, and parts of fructification. I have named it in compliment to Aylmer Bourke Lambert, Esq., a vice-president of the Linnean Society, whose splendid labours in investigating the genus *Pinus* are too generally known and appreciated to require any eulogium from me."

Seems to be hardy.

P. Laricio, Poir. Dict. Encycl. v. 339; Loisel. Nouv. Duham. v. t. 67, 71, f. 2; Lamb. Pinet. ed. 2, i. 9, t. 4; Pinet. Wob. 23; Loud. Arbor. Brit. iv. 2206, f. 2081-84, and Encycl. of Trees, 957, f. 1768-69; De Cand. Fl. Fr. iii. 274; Desf. Hist. Arbr. ii. 611; Ant. Conif. 3, t. 2, f. 1, 2; De Chambr. Tr. Prat. Arbr. Résin. 245, pl. iii.

f. 12, 13, and pl. v. f. 6, 7; Link in Linnæa, xv. 494; Schouw. Ann. Sc. Nat. ser. 3, iii. 234; Spach, Hist. Vég. Phan. xi. 384; Endl. Syn. Conif. 178; Lindl. and Gord. Journ. Hort. Soc. v. 219; Knight, Syn. Conif. 27; Carr. Tr. Gén. des Conif. 384; Gord. Pinet. 168; Veitch, Manual Conif. 147; Beissner, Nadelholzk. 238. Πεύκη, Homer, ii. 23, 328. Πεύκη ἰθαία, Theophrast. Hist. Plant. iii. 4. *Pinaster*, Plin. Hist. Nat. xvi. 17. *P. silvestris* *e* *maritima*, Ait. Hort. Kew. ed. 1, iii. 366. *P. silvestris* *maritima*, Ait. Hort. Kew. ed. 1, iii. 366. *P. maritima*, Ait. Hort. Kew. ed. 2, v. 315 (not Lam. nor Lamb.). *P. Pinaster*, Mor. Stirp. Sard. Elench. i. 42 (not Sol.). *P. Laricio* *Poiretiana*, Ant. Conif. 3, t. 2, f. 1; Endl. Conif. 179. *P. Laricio corsicana*, or *corsica*, hort.

Habitat.—Southern Europe, and many parts of Western Asia; the islands in the Mediterranean Sea, particularly Corsica, Sardinia, and Sicily. Very common on Mount Etna, from 4,000 to 6,000 feet elevation.

Introduced into England in 1759, under the name of *Pinus silvestris* *maritima*.

P. Laricio has done well at Christiania. It has ripened seeds at the Botanic Gardens of Upsala.

There can be little doubt that this is the best all-round Conifer that has yet found its way into the British Isles, and we predict that ere long the number of Corsican Pines to be found in woods and plantations will far exceed that of any other introduced or native species. It is of very rapid growth, and is well suited for planting, even in the most exposed and wind-swept situations; is not fastidious as to soil, and is perhaps the most valuable timber-producing tree that has ever been brought before the British arboriculturist.

As an ornamental tree it is almost superfluous to say one word in its favour, its light, airy appearance being well known to every tree-lover. We do not wish it, however, to be inferred that it can in point of ornament compare with several other species, although it will be admitted it is worthy of at least second rank. From our own experience of home-grown wood of the Corsican Pine, it is, so far as lasting qualities are concerned, second to none of those we have tried. It is strong, tough, elastic, very resinous, and easily worked, and this is speaking of trees of fully fifty years' growth. We have used home-grown *Laricio* wood for many purposes, and always with the most satisfactory results, some of the largest planks being fully 27 inches wide, and cut from trees that girthed nearly 9 feet at a yard from the ground. Recently we examined several planks which were sawn up seven years ago, and find that they are little the worse for the wear and tear to which they have been subjected. In France extensive plantations of this Pine have been formed, while the Prussian Government has introduced it into the State forests (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

P. L. austriaca, Endl. Syn. Conif. 179. *P. Laricio* γ *nigricans*, Parl. in DC. Prodr. xvi. 2, 387. *P. austriaca*, Höss. Monogr. der Schwarzföhre, Wien, 1831. *P. nigricans*, Host. Fl. Aust. ii. 628. *P. nigra*, Lk. in Abhandl. d. Berl. Akad. 1827, 173. *P. Pinaster*, Bess. Fl. Galiz. ii. 294. *P. maritima*, Koch, Syn. ed. 1, 667. *P. dalmatica*, Wis. Fl. Dalmat. i. 129. *P. silvestris*, Baumg. Fl. Transylv. ii. 203.

This tree has of late years attracted considerable attention, not only from its perfect hardihood, but from its ornamental appearance and the shelter it affords to other less hardy kinds. As an ornamental tree it is certainly not behind many of its neighbours, with its wealth of dark, glossy, and shaggy foliage and pleasing contour. For planting in clumps or masses it is particularly well suited; indeed few Pines form a more striking feature in the landscape than this tree does when arranged in irregular clumps. Single specimens, when allowed plenty of room on the greensward, are highly attractive, and produce in a short space of time masses of the richest green foliage, which contrast well with other Conifers of a light or silvery appearance.

As a timber tree it is not without value, and several experiments made with the wood prove that it is very durable, and one of the few kinds that may be used where it is subjected to wet and dry alternately. Seven years ago we cut up two large trees of this Pine, and placed the planks side by side with those of the Scots and Spruce Firs to hold up the sliding banks of a river, each being marked and noted for future observations, and on examining these a year ago the Austrian Pine seemed quite sound, but a lighter colour than when placed in position. Sufficient time, however, has not elapsed for us to speak with any amount of assurance as to the superiority of the wood of this tree over that of either the Spruce or Scots Firs; but from the present appearance of gates, stiles, and posts manufactured some years ago, there can be little doubt that it will, so far as lasting qualities are concerned, be quite equal to either of the other two. It is remarkably strong, tough, coarse of grain, very resinous, works well, and takes a good polish. A native of Austria, and introduced into Great Britain in 1835 (Trans. Scot. Arb. Soc. xii. pt. 2).

P. L. austriaca, in Danish gardens, has attained a height of about 70 feet. Plants about fifty years old measure 60 feet high and more; but among plantations, especially in poor soil, they have been a failure, as the plants, after some years of good growth, have died. It suffers much in many places from *Lophodermium Pinastri*.

P. L. austriaca is to be found planted here and there in Norway, e.g. at Christiania, Drontheim (Trondhjem), Stenkjor, and even as far north as Kabelvang, in Lofoten (68° 12'), where it has done well for several years. The largest tree I have seen in Norway stands in the Botanic Gardens at Christiania. It was planted in 1842, and was then about a foot high (31 cm.), it being now about 47 or 48 years of

age. It is 38 feet high, and the stem measures 4 feet in circumference. It has several times ripened sound seeds. In Sweden it is also found at Stockholm (59° 10'), and in Finland as far north as Wiborg (60° 45') (Prof. F. C. Schübeler, "Viridarium Norvegicum," 1886).

P. L. austriaca fastigiata. This is a variety characterised by a more or less columnar outline.

P. L. austriaca variegata, hort. *Pinus austriaca variegata*, hort.

P. L. calabrica, Delam. *P. calabrica*, Delam. *P. Laricio stricta*, Carr. Conif. ed. 2, 492. *P. L. italica*, hort. *P. romana*, hort.

P. L. monspeliensis, hort. *P. monspeliensis*, Salzm. *P. Salzmannii*, Dunal. in Mém. Acad. Scien. de Montp. ii. 81 (*cum ic.*). *P. Laricio tenuifolia*, Parl. in DC. Prodr. xvi. 2, 387. *P. L. β pyrenaica*, Gren. and Godr. (not Lap.). *P. L. γ cebennensis*, Gren. and Godr. *P. L. leptophylla*, Crist. Europ. Abiet. 15.

We have nice plants of this form. Hardy in Denmark.

P. L. Pallasiana, Endl. Conif. 179. *P. Pallasiana*, Lamb. Pin. ed. 2, 11, t. 5. *P. maritima*, Pall. Index. Taur. *P. caramanica*, Oliv. *P. Laricio caramanica*, Spach. Hist. Vég. Phan. xi. 385. *P. taurica*, hort. *P. tatarica*, hort. *P. halepensis*, Bieb. Flor. Taur. Cauc. ii. 408 (not Mill.). *P. Fenzli*, Ant. and Kotsky.

Habitat.—The Crimea, forming forests of considerable extent on the slopes of the mountains in the neighbourhood of the south coast.

Introduced by Messrs. Lee and Kennedy in 1790.

P. L. Pallasiana, planted in 1845, now measures 47 feet in height and 5 feet 2 inches in girth.

P. leiophylla, Schiede and Deppe in Linnæa, v. 354, and xii. 490; Lamb. Pinet. ed. 2, i. 38, t. 21; Loud. Arbor. iv. 2273, f. 2186-87, and Encycl. of Trees, 1011, f. 1891-93; Forb. Pinet. Wob. 74, f. 28; Ant. Conif. 39, t. 18, f. 2; Spach, Hist. Vég. Phan. xi. 401; Endl. Syn. Conif. 155; Knight. Syn. Conif. 33; Lindl. and Gord. Journ. Hort. Soc. v. 215; Carr. Man. des Pl. 350, and Tr. Gén. Conif. 320; Gord. Pinet. 329; Henk. and Hochst. Syn. der Nadelh. 100 (excl. syn. Roetzl.).

Habitat.—Mexico, especially in cool regions of the mountains of Angangüeo; also on the mountains of Oaxaca, in the province of Necuachan.

Introduced about 1839.

I do not think we possess this plant in Denmark, but I have cones of it in my collection.

P. leucodermis, Ant. in Oester. Bot. Zeitsch. 1864, xiv. 366; Beck, Flor. von Südbosn. in Annal. Naturhist. Hofmus. Wien, ii. 37 (1887), and Boiss. Fl. Orient. s. 697.

Habitat.—Dalmatia, Montenegro, Herzegovina, South Bosnia,

and in Servia. Prof. Hausknecht, of Weimar, found many plants of this species, always on chalky ground.

Introduced in 1864 by Maly, court gardener, who discovered it and brought it home to Belvidere, in Vienna.

Of this interesting species there is given a good description by Prof. Günther, Knight of Beek von Managetta, in the *Wiener Illustr. Gartenzeitung*.

We possess only very young plants, but these may prove hardy.

P. longifolia, Roxb. Mss. ; Fl. Ind. Orient. iii. 651 ; Lamb. Pinet. ed. 2, i. 43, t. 26, 27 ; Royle, Himal. 32, t. 85, f. 2 ; Loud. Arbor. iv. 2252, f. 2148-52, and Encycl. of Trees, 996, f. 1865-66 ; Forb. Pinet. Wob. 55, t. 20 ; Loisel. Nouv. Duham. 247 ; Ant. Conif. 29, t. 9 ; Link in Linnaea, xv. 508 ; Spach, Hist. Vég. Phan. xi. 390 ; Hoffm. Bot. Zeit. 1846, 184 ; Endl. Syn. Conif. 158 ; Lindl. and Gord. Journ. Hort. Soc. v. 216 ; Knight, Syn. Conif. 30 ; Carr. Man. des Pl. iv. 351, and Tr. Gén. Conif. 332 ; Gord. Pinet. 200 ; Henk. and Hochst. Syn. der Nadelh. 72 ; Beissn. Nadelh. 251. *P. Serenagensis*, Madd. ex Gord. l. c. (?) *P. Timoriensis*, Loud. ex Henk. and Hochst. l. c.

Habitat.—Along the Himalayas from Bhotan to Afghanistan, at an elevation of about 1,025 feet above sea-level ; at Simla on higher elevations ; in Kamaon and Gurhwal, north as far as the Pindur, large forests are to be found mostly comprising this species only.

It is called "Cheer" by the hill people in India—a word, according to some, meaning "bark," or "rind," so conspicuous on old trees ; but, according to others, from its milk or turpentine, which it produces in great abundance. It is called "Sulla" by the mountain people from Nepaul to Buschur, a term denoting "to spread fragrance," which this tree does to a remarkable extent. On the upper banks of the Thelum River it is styled by the people "Anunder" ; and throughout Kangara and the eastern hills it is named "Cheel," "Gulla," and "Thansa," or "Tanshing." There are two varieties : one, which has its woody fibre twisted, but open in the grain, and of a white colour, and called "Kutchu" by the natives ; the other, in which the fibres are straight, has reddish and compact wood, and is called "Pucka" ; but this character is not permanent, as sometimes the wood, though white, is compact and straight-fibred. The reddish wood, however, is preferred by the natives, and sold under the name of "Dadar." The twisted kind, being subject to warp and split, is rejected, and never used for architectural purposes ; but the Cheel timber, found growing in all places at an elevation of 5,000 feet and upwards, with a northern aspect and on poor soil, is invariably the straight-fibred kind, and the timber is good. Again, in southern localities and lower down, it is twisted in the fibre, and of but little use for housebuilding and similar purposes. The better variety, however is extensively used for boat-building in India ; but boats built

of its wood do not last more than six or seven years, the timber being liable to rot if exposed to the weather; while, on the other hand, if protected, it is well adapted for housebuilding purposes, although for shipbuilding and spars it is almost useless, as it resists so badly the effects of the weather, and is so soft; but the quality of its timber differs more, perhaps, than that of any other Pine, in consequence of its growing in high or low situations. The forests near Almorah, at an elevation of 4,500 feet, produce excellent timber for domestic purposes, under the name of "Surul" (straight), either from the tall, straight, branchless stems of old trees, or from the woody fibre rending freely and quite straight in the grain. In the Sanscrit dialect it is called "Tanshing," or "Tansa" (Needle-tree), on account of its long, needle-like leaves. The seeds are eaten in India.

This species attains a height of from 60 to 100 feet, and is confined in a great measure to the outer or lower ranges of the mountains, commencing as low as 1,000 feet above the level of the sea, and is rarely, if ever, found at a greater elevation than 7,000 feet, but appears to have a very great power of enduring variations of climate, for it seems equally at home in the hot, damp valleys of Sikkim as on the dry, stony hills of the Punjab, where rain hardly ever falls, and it is at all seasons exposed to a powerful and scorching sun. It is very common throughout the whole region of the Punjab, and as far to the east as Bhotan, occurring at all intermediate altitudes, and where, from the diversity of climate and different aspects in which it grows, it is known under various names. It also abounds in all the lower and outer ranges of the Himalayas, from Bhotan to Afghanistan. Dr. Griffith describes it as descending in Bhotan to the low elevation of 1,800 or 2,000 feet above the sea, while on the ranges between the Jumna and Sutlej it is abundant at from 2,500 to 3,000 feet of elevation, and finally it becomes stunted, and disappears at Simla, at an elevation of 7,000 feet, but occurs in greatest perfection and abundance at Kamaon and Gurhwal, north of the Pindur, at from 2,500 to 7,000 feet of elevation, which places seem little else than one great forest of the Cheer Pine. It has a rough bark, divided by deep fissures into large and longish plates, and the stems of the larger trees are about 12 feet in girth, with a clear stem 40 or 50 feet from the ground, and with an exceedingly picturesque head, very irregular in outline, as the branches are irregularly and thinly scattered. A large quantity of tar and turpentine is extracted from the wood, and the chips are used for candles in India, and called "Chamsing" (night-lights); and, according to Dr. Hooker, ink is made in Sikkim from the charcoal of the burnt leaves mixed with rice-water (G. Gordon, "The Pinetum").

The wood is made into charcoal. Weight of wood 37 to 45 lbs. per cubic foot (F. M. Bagley, "Cat. of Plants, Brisbane Bot. Gardens").

It has been wintered indoors in Denmark. One plant, however, exposed out of doors does not appear to have suffered.

P. macrophylla, Lindl. Bot. Reg. 1839, app. 63 ; Spach, Hist. Vég. Phan. xi. 402 ; Loud. Encycl. of Trees, 1006, f. 1885-86 ; Endl. Syn. Conif. 153 ; Lindl. and Gord. Journ. Hort. Soc. v. 215 ; Knight, Syn. Conif. 33 ; Carr. Tr. Gén. Conif. 315 ; Gord. Pinet. 231 ; Henk. and Hochst. Syn. der Nadelh. 106 (excl. syn. Roezl). *P. Leroyi*, Roezl, ex Gord. l. c.

Habitat.—Mexico. Hartweg found it, but sparsely, on Ocotillo, one of the highest tops of the Angangueo Mountains.

We have no plant under observation, but there are interesting cones in my collection.

P. mandschurica, Rupr. Hardy. This plant may later on be otherwise determined.

P. Massoniana, Lamb. Pinet. ed. 2, 20, t. 8. *P. sinensis*, Lamb. Pinet. ed. 2, iii. 127, t. 53 ; Loud. Arbor. iv. 2264, f. 2167-69, and Encycl. of Trees, 999, f. 1873-74 ; Ant. Conif. i. t. 1, f. 1 ; Forb. Pinet. Wob. 39, t. 12 ; Endl. Syn. Conif. 158 ; Lindl. and Gord. Journ. Hort. Soc. v. 216 ; Knight, Syn. Conif. 30 ; Carr. Man. des Pl. 351, and Tr. Gén. Conif. 331 ; Gord. Pinet. 209 (excl. syn. Sieb.). *P. Kesyia*, Royle, Mss. Gard. Mag. 1840, 8. *P. nepalensis*, Forb. Pinet. Wob. 34 ; Ant. Conif. 23. *P. Cavendishiana*, Paxt.

Habitat.—South-eastern China, Formosa.

P. Massoniana, Lamb., Parl., is well distinguished from the tree thus named by Siebold and Zuccarini (180), and by Endlicher, and which was named by Parlatore *P. Thunbergii*.

This Pine may not be hardy in Denmark. A couple of plants received under this name, and which probably were the true *Pinus sinensis*, Lamb., died a year after planting.

P. mitis, Michx. Hist. Arb. Amer. i. 52, t. 3, N. Amer. Sylv. iii. 120, t. 137, ed. 3, iii. 96, t. 137, and Fl. Bor. Amer. ii. 204 ; Barton, Prodr. Fl. Philadelph. 93 ; Poir. Suppl. iv. 417 ; Loud. Arbor. iv. 2195, f. 2072-76 ; Ant. Conif. 16, t. 5, f. 1 ; Lindl. in Penn. Cycl. xvii. 171 ; Spach, Hist. Vég. Phan. xi. 386 ; Torr. Fl. N. York, ii. 229 ; Endl. Syn. Conif. 167 ; Knight, Syn. Conif. 26 ; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 217 ; Carr. Tr. Gén. Conif. 361, and ed. 2, 472 ; Gord. Pinet. 173, and ed. 2, 243 (excl. syn. *Roylei*) ; Cooper in Smithsonian Rep. 1858, 275 ; Chapman, Fl. S. States, 433 ; Curtis in Rep. Geolog. Surv. N. Carolina, 1860, iii. 19 ; Lesquereux in Owen's 2nd Rep. Arkansas, 389 ; Wood, Cl. Book, 660, and Bot. and Fl. 313 ; Henk. and Hochst. Nadelh. 23 ; Gray, Man. N.U. States, ed. 5, 470 ; Hoopes, Evergreens, 88 ; Parl. DC. Prodr. xvi. 2, 380 ; Young, Bot. Texas, 516 ; Koch, Dendr. ii. 2, 300 ; Vasey, Cat. Forest Trees, 30 ; Broadhead in Coulter's Bot. Gaz. iii. 60 ; Engelm. in Trans. St. Louis Acad. iv. 184 ; Ridgway in Proc. U.S. Nat. Mus. 88 ; Veitch, Man. Coniferæ, 158 ; Beissner, Nadelholzk. 216. *P. variabilis*, Pursh, Fl. of N. Amer. ii. 643. *P. echinata*, Mill. Dict. n. 12 ; Wangenh. Beiträge, 74 ;

Marsh. Arbor. 100 ; Du Roi, Obs. Bot. 44, and Harbk. ed. Pott. ii. 51. *P. Tæda γ variabilis*, Ait. Hort. Kew. ed. 1, iii. 363. *P. Roylei*, Lindl. *P. lutea*, Lodd. *P. turbinata*, Bosc. *P. intermedia*, Fisch. ex Gord. Pinet. 170.

Habitat.—Staten Island, New York, south to the Chattahoochee region of Western Florida, through the Gulf States to Tennessee and Eastern Texas, and through Arkansas to the Indian Territory, South-eastern Kansas, Southern Missouri, and in Union County, Illinois.

A tree 80-100 feet in height, with a trunk 2-5 feet in diameter ; light sandy soil, or, less commonly, along the low borders of swamps, forming west of the Mississippi River, mixed with Oaks and other deciduous trees, extensive forests ; the only species of Northern Arkansas, Kansas, and Missouri, reaching its greatest development in Western Louisiana, Southern Arkansas, and Eastern Texas.

Wood, varying greatly in quality and amount of sap, heavy, hard, strong, generally coarse-grained, compact ; bands of small summer cells broad, often occupying half the width of the annual growth, very resinous, resin passages numerous, large ; medullary rays numerous, conspicuous ; colour orange, the sapwood nearly white ; specific gravity, 0·6104 ; ash, 0·29 ; largely manufactured into lumber, especially in the States west of the Mississippi River, and among Yellow Pines only inferior in value to that of *P. palustris* (C. S. Sargent).

Introduced in 1739. This is the Pine which produces the valuable "yellow pine" timber of commerce. The tree does not often exceed 80 feet in height. Although possessing no special ornamental property, it should be planted for the sake of its timber. Its habit of growth very much resembles that of *Pinus silvestris*, and the trunk is almost of uniform girth for nearly two-thirds of its length (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

P. mitis has in Denmark attained to nearly 60 feet in height, but young plants of this species sometimes appear to suffer much.

P. monophylla, Torr. and Fremont, Rep. of the Expl. Exped. to the Rocky Mountains, 1842, and to Oregon and North Calif. in 1843-44, 312, t. 4. *P. Fremontiana*, Endl. Conif. 183.

Habitat.—Near Utah Lake, Utah, to the eastern foot-hills of the Californian Sierras, south along the mountain ranges of the Great Basin to the San Francisco mountains of Northern Arizona.

A small, bushy tree, 13-20 feet in height, with a trunk sometimes 3 feet in diameter ; dry, gravelly slopes and mesas between 3,000 and 6,000 feet elevation (C. S. Sargent).

Seems to do well out of doors in Denmark.

P. montana, Mill. Gard. Dict. n. 5. *P. Mughus*, Scop. Fl. Carn. ed. 2, ii. 247, t. 9. *P. Pumilo*, Haenke, Bot. Bemerk. of Reise ins Riesengebirge, s. 68. *P. uncinata*, Ramd. in DC. Franc. ed. 3, iii. 726.

Habitat.—Mountains of Central Europe, especially in Austria, South Germany, Switzerland, and Southern France; on the Pyrenees, &c.

During the last twenty years and more, many millions of *Pinus montana* have been planted annually, especially in Jutland, on our poorest ground. No country probably has propagated this plant on such a large scale. The *uncinata* form is the best.

P. Montezumæ, Lamb. Pinet, ed. 2, i. 39, t. 22; Schlecht. in Linnæa, xii. 489; Ant. Conif. 38, t. 17, f. 1; Spach, Hist. Vég. Phan. xi. 401; Loud. Encycl. of Trees, 1004, f. 1881-84; Gord. Journ. Hort. Soc. i. 234 (*cum ic.*); Lindl. and Gord. l. c. v. 215; Endl. Syn. Conif. 154; Knight, Syn. Conif. 33; Carr. Man. des Pl. iv. 349, and Tr. Gén. Conif. 317; Gord. Pinet. 232; Henk. and Hochst. Syn. der Nadelh. 97 (excl. syn. Roetzl). *P. occidentalis*, Humb. Bonpl. and Kunth, Nov. Gen. et Sp. ii. 4; Deppe in Linnæa, v. 76 (not Swartz).

Habitat.—In different parts of Mexico, in great numbers. Schiede found it between Perote and the Hacienda de Flachichuca, at the foot of the Orizaba. Humboldt found it in South Mexico.

Introduced into Europe in 1839.

It has succeeded very well out of doors, protected during the hardest part of winter with a mat of straw.

P. monticola, Douglas Mss.; Lamb. Pin. ed. 1, iii. 27, t. 35; Loud. Arbor. iv. 2291, f. 2208, 2209; Forb. Pinet. Wob. 81, t. 31; Ant. Conif. 40, t. 18, f. 3; Hook. and Arnott, Bot. Beechey, 394; Endl. Syn. Conif. 148; Lind. and Gord. in Journ. Hort. Soc. Lond. v. 215; Carr. Tr. Gén. Conif. 305, and ed. 2, 401; Gord. Pinet. 233, and ed. 2, 314; Cooper in Smithsonian Rep. 1858, 262, Pacific R.R. Rep. xii. 2, 27, and Am. Nat. iii. 410; Lyall in Journ. Linn. Soc. vii. 141; Henk. and Hochst. Nadelh. 94; Nelson, Pinac. 120; Hoopes, Evergreens, 135; Bolander in Proc. Calif. Acad. iii. 318; Parl. in DC. Prodr. xvi. 2, 405; Gray in Proc. Am. Acad. vii. 402; Fowler in Lond. Gard. Chron. 1872, 1071; Koch, Dendr. ii. 2, 322; Vasey, Cat. Forest Trees, 32; Macoun in Geolog. Rep. Canada, 1875-76, 211; Hall in Coulter's Bot. Gaz. ii. 91; Engelm. in Bot. Calif. ii. 123; G. M. Dawson in Canadian Nat. new ser. ix. 328; Veitch, Man. Conif. 181, f. 41; Lawson, Pinet. Brit. i. 69, f. 1-6; Beissner, Nadelholzk. 293. *P. Strobilus monticola*, Nutt. Sylv. N. Amer. ii. 177.

Habitat.—Vancouver's Island, coast and gold ranges of Southern British Columbia, through the Cœur d'Allène and Bitter-root Mountains of Idaho to the valley of the Flathead River, Northern Montana (Canby and Sargent); south along the Cascade Mountains of Washington Territory and Oregon, and the Californian Sierras to Calaveras County.

First discovered and introduced by Douglas in 1831; since then collected by many explorers. Jeffrey, Murray, Beardsley, Bridges,

Lobb, &c., have all aided in introducing it into England ("Pinetum Britannicum," 1884, vol. i.).

It does not occur in any of the botanical lists of the different United States exploring expeditions which crossed the continent within the United States territory for the purpose of ascertaining the best route for a railroad to the Pacific. This may have been due to the distribution of the tree being local, as these expeditions only crossed the country transversely from east to west, and did not explore it longitudinally from north to south, while the expeditions which have done so found it.

A large tree, 100-150 feet in height, with a trunk 3-5 feet in diameter; most common, and reaching its greatest development, in the Pend d'Oreille and Clark's Fork regions of Idaho—here a valuable and important timber tree; in British Columbia generally below 3,000 feet, and in California between 7,000 and 10,000 feet elevation; not common (C. S. Sargent).

P. monticola is so nearly allied to the Weymouth Pine (*P. Strobus*), that Loudon thought this might only prove a variety of it, and consequently only separated them provisionally, until an opportunity occurred of examining the male catkins and ascertaining other particulars. This information we now have, and no doubt exists as to its being a distinct species from *P. Strobus*. The only doubt now is whether two species are not included under the name *P. monticola*. It is a handsomer tree than *P. Strobus*, its green is darker and richer, the leaves are stiffer and less serrulate, while its beautiful orange-coloured cones add to its attractions. It seems less liable to break, and consequently has more rarely double branches or competing leaders than the Weymouth Pine.

That such a beautiful and free-growing tree has now, after a fair trial, been found to be well suited for planting in British woodlands is a matter of the greatest importance, for certainly few members of the Pine family combine the useful with the ornamental in so high a degree. *P. monticola* is a very handsome tree, about midway in appearance between *P. Cembra* and *P. Strobus*. The contour of a fair-sized specimen may be called pyramidal, not so much, however, as in *P. Cembra*, with an abundance of rather short branches, well clothed with dark rich green foliage. More, perhaps, as an ornamental tree than as a valuable timber-producer is this Pine known to us; yet in this latter respect it is certainly far from valueless, as fine samples of its timber, as well as the various uses to which it is applied, clearly point out. The timber, of which a plank 18 feet long, 46 inches wide, and 3 inches thick, was once exhibited, was well packed and firm, not of too deep a colour, and well adapted for using where strength and lasting qualities are of first importance. The value of the wood, as grown in England, has not yet been fairly tested. As an ornamental tree it, however, occupies the front rank (Trans. Roy. Scot. Arb. Soc. xii. pt. 2),

Pinus monticola, planted in 1876, is now 19 feet high, with a girth of 1 foot. I am unable to say if taller specimens are to be found in Denmark. It has produced cones.

P. monticola cærulescens. This is a variety with a more glaucous appearance than the type.

P. muricata, Don in Linn. Trans. xvii. 441. *P. Edgariana*, Hartw. in Journ. Hort. Soc. iii. 217, 226.

Habitat.—California, Mendocino County, south through the coast ranges to San Luis, Obispo County.

Introduced into Europe in 1846.

Is perhaps not hardy in Denmark.

This very distinct Pine was first discovered by Dr. Coulter at San Luis, Obispo, in Upper California, to the south of Monterey, at an elevation of 3,000 feet, and within ten miles of the seashore. It grows straight, but rather stunted, seldom exceeding 40 feet in height. Mr. Hartweg found it growing on the western declivity of the mountains near Monterey, and within two miles of the seashore, attaining a height of from 20 to 30 feet, and with a trunk 12 inches in diameter. In this locality it was confined to a small wood half a mile square, and intermixed with and surrounded by *Pinus insignis*. Mr. Hartweg again met with it at a considerable distance to the south of Monterey, on the ascent to the mission of La Purissima, where the monotony of the bare hills was only relieved by a small forest of it; the trees, however, not attaining a larger size than those found growing near Monterey. Mr. Jeffrey found it a tree 40 feet high, of a conical form, on the Siskiyou Mountains, at an elevation of 7,500 feet, growing in moist soil, near the summit of the mountain. It was named *P. Murrayana* by the Oregon Committee, and *P. Edgariana* by Hartweg in the Journal of the Royal Horticultural Society. It is the "Obispo," or Bishop's Pine, of the Californians, and has been found to be quite hardy in England (G. Gordon, "The Pinetum," 1875.)

This is a very distinct Pine, the irregular appearance of its branches and clustered prickly cones being different to those of any other with which I am acquainted. From its rather unusual appearance it is worthy of a corner in the pinetum. It is perfectly hardy, not at all fastidious as to soil or situation, of the easiest culture, and valuable for planting as game shelter, or for the ornamentation of high-lying and breezy situations (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

P. Murrayana, Balfour, Rep. Oreg. Exped. 2, t. 3, f. 2. *P. contorta* var. *Murrayana*, Engelm. in Bot. Calif. *P. contorta*, Newberry in Pacific R.R. Rep. *P. inops*, Benth. Pl. Hartw. 337. *P. contorta* var. *latifolia*, Engelm. in King's Rep. v. 331. *P. contorta latifolia*, Engelm. in Porter's Fl. Colorado. *P. (?) Boursieri*, Carr. Conif. ed. 2, 475.

Introduced into Europe since 1830.

Habitat.—Valley of the Yukon River, Alaska (Fort Selkirk, Dall.) ; south through the interior of British Columbia, along the mountain ranges of Washington Territory and Oregon, and the Sierra Nevadas of California to Mount San Jacinto; on the high plateau east of the Rocky Mountains in about latitude 56°, and south through the mountains of Idaho, Montana, Wyoming, Colorado, and Utah to New Mexico and Northern Arizona.

A tree 60–80 feet in height, with a trunk 2–4 feet in diameter, reaching its greatest development in the Californian Sierras ; in the interior regions in dry, gravelly soil—here the prevailing tree, covering immense areas, and generally replacing other species destroyed by fire ; in Western Washington Territory, and southward, only along the borders of moist alpine meadows between 6,000 and 9,000 feet elevation ; generally confounded with the closely allied *P. contorta* of the coast, from which it may be distinguished by its longer, broader leaves, very thin, scaly bark, thin sapwood, and less resinous and finer-grained wood, resembling that of the White Pines ; the distribution of the two species in Northern British Columbia and Alaska is still undetermined.

Wood light, soft, not strong, close, straight-grained, easily worked, compact, not durable ; bands of small summer cells narrow, not conspicuous, resin passages few, not large ; medullary rays numerous, obscure ; colour light yellow or nearly white, the thin sapwood lighter ; specific gravity, 0.4096 ; ash, 0.32 ; occasionally manufactured into lumber, and used for fuel, railway ties, &c. (C. S. Sargent).

Hardy. Has ripened cones in Denmark.

P. occidentalis, Swartz, Prodr. 103, and Fl. Ind. Occid. ii. 1230 ; Loisel. Nouv. Duham. v. 250, t. 72, f. 2 ; Lamb. Pinet. ed. 2, i. 40, t. 22 ; Ant. Conif. 40, t. 18, f. 1 ; Loud. Arbor. iv. 2271, f. 2183, and Encycl. of Trees, 1015, f. 1901 ; Endl. Syn. Conif. 154 ; Lindl. and Gord. Journ. Hort. Soc. v. 215 ; Carr. Man. des Pl. 350, and Tr. Gén. Conif. 318 ; Gord. Pinet. 234 ; Henk. and Hochst. Syn. der Nadelh. 101 (not J. E. Nelson, Pinac.). *Larix americana, foliis quinis, ab eodem exortu*, Tourn. Inst. 586. *P. foliis quinis, ab eodem exortu*, Plum. Cat. 17, and Pl. Amer. 154, t. 161. *P. cubensis*, hort. ex Gord. l. c.

Habitat.—On the mountains in the middle of St. Domingo, parts of Cuba, and the Isle of Pines.

Introduced into Europe in 1820.

We have no plants of it in cultivation in Denmark, but I possess cones brought home by the Danish botanist and plant collector, Baron Eggers.

P. oocarpa, Schiede in Linnæa, xii. 491 ; Loud. Encycl. of Trees, 1012, f. 1894–98 ; Ant. Conif. 39, t. 17, f. 2 ; Endl. Syn. Conif. 152 ; Lindl. and Gord. Journ. Hort. Soc. v. 215 ; Knight, Syn. Conif. 33 ; Carr. Man. des Pl. iv. 348, and Tr. Gén. Conif.

312 ; Gord. Pinet. 234 ; Henk. and Hochst. Syn. der Nadelh. 9. ; J. E. Nelson, Pinac. 122.

Habitat.—Mexico. Schiede and Hartweg found it between Ario and the Vulcan Jorullo, and in other temperate parts of Mexico.

Introduced to R.H.S. Gardens, Chiswick, in 1840.

We do not possess plants of this species, but I have cones in my collection.

P. oocarpoides, Benth. Mss. ; Henk. and Hochst. Syn. der Nadelh. 99 ; Lindl. and Gord. Journ. Hort. Soc. v. 215. *P. oocarpa* var. *oocarpoides*, Endl. Syn. Conif. 152 ; Carr. Tr. Gén. Conif. 313 ; Gord. Pinet. 235. *P. Skinneri*, hort.

Habitat.—Different parts of Mexico and Guatemala.

We have no plants of this, but I have cones in my collection.

P. osteosperma, Engelm. ; Wislitz. Mem. Tour Nth. Mexico 1846-7, 89. *P. cembroides*, Gord. Journ. Hort. Soc. i. 236 (*cum ic.*), not Zucc. *P. Llaveana*, Schiede and Deppe in Linnæa, xii. 488. *P. fertilis*, Roetzl.

Habitat.—Dr. Mayr says it is found in dry, hot parts of Santa Catalina, in Arizona, and in New Mexico.

Introduced into Europe in 1848.

Perhaps we do not yet possess the right plant in Denmark, as it does not resemble native specimens in my herbarium.

P. Parryana, Engelm.

Habitat.—California, Larkin's Station, 20 miles south-east of Campo, San Diego County (Vasey), and southward into Lower California.

A small tree, 20-30 feet in height, with a trunk 12-18 inches in diameter ; very rare within the limits of the United States, south of the boundary forming extensive open forests upon the high mesas and slopes of Lower California (Pringle).

Is perhaps not hardy in Denmark.

P. parviflora, Sieb. and Zucc. Flor. Jap. ii. 27, t. 115 ; Endl. Syn. Conif. 138 ; Carr. Tr. Gén. Conif. 292 ; Gord. Pinet. 236 ; Henk. and Hochst. 120. *P. Cembra*, Thunb. Fl. Jap. 274.

Habitat.—Some authors say that it is only to be found in Japan farther north than 35°. Dr. Mayr found it in Shikoku on Kiushiu. How far north it goes is unknown.

Hardy.

P. p. brevifolia. This is a still more dwarf variety than the type, and is very suitable for small gardens.

P. patula, Schiede and Deppe in Linnæa, xii. 448 ; Lamb. Pinet. ed. 2, i. 36, t. 19 ; Loud. Arbor. iv. 2266, f. 2175-76, and Encycl. of Trees, 992, f. 1855-56 ; Ant. Conif. 35, t. 16, f. 2 ; Spach, Hist. Vég. Phan. xi. 400 ; Endl. Syn. Conif. 157 ; Lindl. and Gord. Journ. Hort. Soc. v. 216 ; Carr. Man. des Pl. iv. 351, and Tr. Gén. Conif. 329, and ed. 2, 427 ; Gord. Pinet, 203 ; Henk. and

Hochst. Syn. der Nadelh. 81 (excl. syn. Roezl); J. E. Nelson, Pinac. 122.

Habitat.—Grows in the colder parts of Mexico, Jaya las Couces, between Lerma and Toluca, and around Real del Monte, to 9,700 feet in height.

Introduced into Europe about 1820. A specimen in Denmark has kept alive, but it may not be quite hardy.

P. Peuce, Griseb. Spic. Flor. Rumel. ii. 349. *P. excelsa* var. *Peuce*, Griseb. *P. Cembra* var. *fruticosa*, Griseb. Reis. in Rumelien, 189–191. *P. excelsa*, Parl. in DC. Prodr. xvi. 2, 405. *P. excelsa*, Hook. Journ. Linn. Soc. viii. 145. *P. Peuce*, Griseb. in Contributions to the History of certain Species of Conifers, by Dr. M. T. Masters, 205.

This species has much shorter leaves and sheaths than has *P. excelsa*.

Habitat.—On the Peristeri Mountains in Macedonia, where it was discovered by Grisebach; on the frontiers of Montenegro, and the Kom, where the Servian botanist Pancic found it. Further, it is to be found at Periamdagh, in the Balkans, where Janka observed it at an elevation of 5,000–6,500 feet.

Introduced into cultivation in 1864.

We have plants about twenty years old, which have developed very well, and proved hardy. Cones have ripened in Denmark.

P. P. argentea. This has a more silvery appearance than the type.

P. Pinaster, Sol. in Ait. Hort. Kew. ed. 1, iii. 367; Lamb. Pinet. ed. 1, i. 9, t. 4, 5, and ed. 2, i. 21, t. 9; Loud. Arbor. Brit. iv. 2213, f. 2100–2101, and Encycl. of Trees, 961, f. 1781–82; Ant. Conif. 18, t. 6, f. 1; Pinet. Wob. 29; Link in Linnæa, xv. 498; Schouw in Ann. Sc. Nat. ser. 3, iii. 235; Endl. Syn. Conif. 168; Lindl. and Gord. Journ. Hort. Soc. v. 217 (excl. syn. *Massoniana*); Knight, Syn. Conif. 27; Carr. Tr. Gén. des Conif. 365; Gord. Pinet. 176; Henk. and Hochst. 25; Beissn. Nadelh. 221. *Pinaster*, Cæsalp. De Plant. lib. 3, cap. 52, p. 130. *P. maritima altera*, C. Bauh. Pin. 492. *P. silvestris* β , L. Spec. Pl. 1418. *P. silvestris*, Mill. Dict. n. 1 (not L.). *P. maritima*, Poir. Dict. Encycl. v. 337. *P. Laricio*, Savo. Fl. Pis. ii. 353 (not Poiret). *P. nepalensis*, Royle and hort. aliq. *P. Latteri*, Madden ex Gord. Pinet. 176. *P. syrtica*, Thor. Prom. in Gascogn. 161. *P. Novæ Hollandiæ*, Lodd. *P. Novæ Zealandia*, Lodd. *P. St. Helenica*, Loud. *P. neglecta*, Low. *P. japonica*, hort. aliq. *P. chinensis*, Knight, ex Gord. Pinet. 176.

Habitat.—The Mediterranean countries of Europe, chiefly in the neighbourhood of the coast; also in Algiers. It is particularly abundant in the South of Portugal, in many parts of Spain, and in the West and South of France.

Introduced into England by Gerard in 1596. “The ornamental

effect of this Pine is not much appreciated ; neither is the quality of its wood. It has often been highly recommended for seaside planting, but with ruinous results in the following instances. Soon after reading a favourable report upon this Pine which appeared a number of years ago, a landed proprietor on the west coast planted it extensively, with the result that scarcely a plant survived the first year. I have also tried it, and the failure could not have been greater if I had used a tropical plant. There are said to be several varieties of the Pinaster, and possibly we may not have the hardiest one, which grows so abundantly in the West of France. Unless we can import the hardiest variety, I don't think we shall ever grow the Maritime (or Cluster) Pine in sufficient numbers on our seaboard to supply us with pitch, tar, resin, and other products of the Pinaster. I would advise the British landowner rather not to purchase them than risk their failure on bleak seaside exposures" (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

P. P. Hamiltoni, Parl. in DC. Prodr. xvi. 2, 383. *P. Hamiltonii*, Ten. Cat.; Orton, Bot. Napol. 1845. (?) *P. Pinaster major*, Duham. Arbr. ii. 133, t. 28, No. 2, ex DC. Fl. Fr. iii. 273. *P. Pinaster altissima*, Lamb. *P. Cortearna*, hort.

It was introduced to England in 1825 by the Earl of Aberdeen, from the neighbourhood of Nice.

P. P. Lemoniana, Endl. Syn. Conif. 169 ; Loud. Encycl. of Trees, 963, f. 1783-84 ; Lindl. and Gord. Journ. Hort. Soc. v. 217 ; Knight, Syn. Conif. 27. *P. Lemoniana*, Benth. in Hort. Trans. ser. 2, i. 512, t. 20 ; Spach, Hist. Vég. Phan. xi. 400.

P. Pinea, L. Spec. Pl. 491 ; Du Roi, Harbk. ed. Pott. ii. 52 ; Lamb. Pinet. ed. 1, i. 11, t. 6-8, and ed. 2, i. 23, t. 10, 11 ; Loud. Arbor. Brit. iv. 2224, f. 2106-2109, and Encycl. of Trees, 965, f. 1787-89 ; Desf. Hist. Arb. ii. 611 ; Loisel. Nouv. Duham. v. t. 72, 73, f. 3 ; DC. Fl. Fr. iii. 273 ; C. Gay, Fl. Chil. v. 418 ; Ant. Conif. 20, t. 3, f. 2 ; Link in Linnea, xv. 499 ; Griseb. Spicileg. Fl. Rumel. ii. 347 ; Pinet. Wob. 31, t. 10 ; Schouw, Ann. Sc. Nat. ser. 3, iii. 236 ; Spach, Hist. Vég. Phan. xi. 375 ; Endl. Syn. Conif. 182 ; Knight, Syn. Conif. 27 ; Lindl. and Gord. Journ. Hort. Soc. v. 219 ; Carr. Tr. Gén. des Conif. 402 ; Gord. Pinet. 179 ; Veitch, Man. Conif. 154 ; Boissner, Nadelholzk. 220. *P. domestica*, Mathiol. Valgris. 87. *P. sativa*, C. Bauh. Pin. 491. *P. ossiculis duris, foliis longis*, J. Bauh. Hist. i. 248. Pinus, Plin. Hist. Nat. xvi. 16. *P. maderensis*, Ten. in Semp. Hort. Reg. Neapol. 1845. *P. Pinea chinensis*, hort. *P. americana pinea*, hort. *P. japonica*, hort. *P. africana*, hort.

Habitat.—Italy and the Mediterranean region generally, both in Europe and Africa ; also Portugal, Madeira, and the Canary Islands.

Introduced into England before 1548, as it is mentioned in Turner's "Names of Herbes," published in that year.

A conservatory plant once bore a small cone in the Botanic Gardens, Copenhagen. One winter I observed that a young plant kept alive out of doors, but this species cannot be regarded as being hardy in Denmark.

A low tree, with a round, bushy appearance, from 15 to 20 feet high, which produces the "Carpathian balsam." It is found on the sandy coasts of Tuscany, and the States of the Church, to the west of the Apennines, on the hills of Genoa and Tuscany, frequently forming forests with the Cluster Pine (*Pinus Pinaster*), and is cultivated throughout the whole of Italy, from the foot of the Alps to Sicily, but is not commonly found higher than 1,500 feet of elevation, except in the South of Italy, where it grows at an elevation of 2,000 feet. It is cultivated along all the shores of the Mediterranean, and in Greece attains a height of 50 or 60 feet, where its seeds or nuts form an extensive article of commerce, as well as in Italy and the South of France. It forms a very ornamental small tree, with a rounded head, and is celebrated for producing a fine effect in the grounds of Italian villas (G. Gordon, "The Pinetum," 1875).

The seeds are edible; the wood white, light, and full of resin.

The Stone Pine being of a slow growth and rather tender constitution, few specimens of this Pine have attained to large dimensions in Great Britain. As a timber tree in this country it is almost valueless, but its extremely picturesque appearance renders it of great value for ornamental planting. It affords a striking contrast, from its stiff and rounded head, to other trees of an open and informal mode of growth. A native of both Europe and Africa. Introduced prior to 1548 (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

P. ponderosa, Dougl. in Loud. Arb. iv. 2243, f. 2132-37; Companion Bot. Mag. ii. 111; Forb. Pinet. Wob. 44, t. 15; Ant. Conif. 28, t. 8, f. 1; Lindl. in Penn. Cycl. xvii. 172; Link in Linnæa, xv. 506; Nutt. Sylv. iii. 114, and ed. 2, ii. 173; Spach, Hist. Vég. xi. 389; Endl. Syn. Conif. 163; Knight, Syn. Conif. 30; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 217; Carr. Tr. Conif. 340, and ed. 2, 445; Gord. Pinet. 205, Suppl. 67, and ed. 2, 281; Newberry in Pacific R.R. Rep. vi. 36, 90, t. 4, f. 12; Cooper in Smithsonian Rep. 1858, 261, Pacific R.R. Rep. xii. (2), 27, 68, and Am. Nat. iii. 409; Torr. Bot. Mex. Boundary Survey, 209, and Ives' Rep. 28; Engelm. in Am. Journ. Sc. ser. 2, xxxiv. 332, Proc. Am. Phil. Soc. ser. 2, xii. 209, Wheeler's Rep. vi. 261, Trans. St. Louis Acad. iv. 181, and Bot. Calif. ii. 125; Lyall in Journ. Linn. Soc. vii. 142; Bolander in Proc. Calif. Acad. iii. 226, 317; Henk. and Hochst. Nadelh. 71; Nelson, Pinac. 125; Hoopes, Evergreens, 117; Parl. in DC. Prodr. xvi. 2, 395 (excl. syn. *Sinclairii*); Watson in King's Rep. v. 331, and Pl. Wheeler, 17; Gray in Proc. Am. Acad. vii. 402; Fowler in Gard. Chron. 1872, 1326; Koch, Dendr. ii. 2, 310; Rothrock in Pl. Wheeler, 28, 50, and Wheeler's Rep. vi. 9; Porter

and Coulter, Fl. Colorado; Hayden's Surv. Misc. Pub. No. 4, 129; Hayden in Warren's Rep. Nebraska and Dakota, ed. 2, 121; Vasey, Cat. Forest Trees, 30; Hall in Coulter's Bot. Gaz. ii. 91; Macoun in Geolog. Rep. Canada, 1875-76, 211; Brandegee in Coulter's Bot. Gaz. iii. 32; G. M. Dawson in Canadian Nat. new ser. ix. 326; Rusby in Bull. Torr. Bot. Club, ix. 106; Veitch, Man. Conif. 167; Beissner, Nadelholzk. 260. *P. Benthamiana*, Hartw. Journ. Hort. Soc. ii. 189, and iii. 223. *P. Beardsleyi*, Murr. Edin. New Phil. Journ. 1855, 286. *P. Craigiana*, Murr.

Habitat.—Interior of British Columbia, south of latitude 51°; south and east along the mountain ranges of the Pacific region to Mexico, the Black Hills of Dakota, Colorado, and Western Texas; not detected in Central or Southern Nevada.

P. ponderosa, Douglas, is a variable and widespread species of western North America, several forms of which have been described as distinct.

A large tree, 200-300 feet in height, with a trunk 12-15 feet in diameter, or throughout the Rocky Mountain region much smaller, rarely exceeding 100 feet in height (var. *scopulorum*); dry, rocky ridges and prairies, or in Northern California, rarely in cold, wet swamps, reaching its greatest development along the western slope of the sierras of Northern and Central California; in Western Washington Territory and Oregon rare and local; after *Pseudotsuga Douglasii* the most generally distributed and valuable timber tree of the Pacific forests, furnishing the principal lumber of Eastern Washington Territory and Oregon, Western Montana, Idaho, the Black Hills of Dakota, Western Texas, New Mexico, and Arizona.

Wood, varying greatly in quality and value, heavy, hard, strong, brittle, not coarse-grained nor durable, compact; bands of small summer cells broad or narrow, very resinous, conspicuous, resin passages few, small; medullary rays numerous, obscure; colour light red, the very thick sapwood almost white; specific gravity, 0.4715; ash, 0.35; largely manufactured into lumber, and used for railway ties, fuel, &c. (C. S. Sargent, "Forest Trees of North America").

It has done well in Sweden at Alnarp and at Gothenburg, and seems to be hardy in Denmark.

P. p. var. *scopulorum*, Engelm. in Fl. Calif. ii. 125. *P. ponderosa*, by botanists from the Rocky Mountains.

Habitat.—According to Engelmann, it is to be found on the whole of the Rocky Mountains.

Seems to be hardy.

P. pseudostrobus, Lindl. Bot. Reg. 1839, 63; Loud. Encycl. of Trees, 1008, f. 1888; Spach, Hist. Vég. Phan. xi. 402; Endl. Syn. Conif. 156; Lindl. and Gord. Journ. Hort. Soc. v. 216; Carr. Man. des Pl. iv. 350, and Tr. Gén. Conif. 321; Gord. Pinet. 237; Henk. and Hochst. Syn. der Nadelh. 104 (excl. syn.).

Habitat.—It is a native of the mountains of Anganguero and Orizaba, and other parts of Mexico.

Not yet proved hardy in Denmark.

P. pungens, Michx. Hist. Arb. Am. i. 61, t. 5, and N. Amer. Sylv. ed. 3, iii. 105, t. 140; Nouv. Duham. v. 236, t. 67, f. 4; Ait. Hort. Kew. ed. 2, v. 314; Pursh, Fl. Am. Sept. ii. 643; Poir. Suppl. iv. 417; Elliott, Sk. ii. 635; Spreng. Syst. ii. 886; Eaton, Manual, ed. 6, 265; Lamb. Pin. ed. 1, iii. 34, t. 17; Loud. Arbor. iv. 2197, f. 2077-80; Forb. Pinet. Wob. 57, t. 21; Eaton and Wright, Bot. 359; Ant. Conif. 18, t. 5, f. 4; Lindl. in Penn. Cycl. xvii. 171; Nutt. Sylv. iii. 125, and ed. 2, ii. 184; Spach, Hist. Vég. Phan. xi. 387; Endl. Syn. Conif. 166; Knight, Syn. Conif. 27; Lindl. and Gord. Journ. Hort. Soc. Lond. v. 217; Carr. Tr. Gén. Conif. 359, and ed. 2, 470; Darby, Bot. S. States, 515; Gord. Pinet. 181, and ed. 2, 254; Cooper in Smithsonian Rep. 1858, 257; Chapman, Fl. S. States, 432; Curtis in Rep. Geolog. Surv. N. Carolina, 1860, iii. 20; Wood, Cl. Book, 660, and Bot. and Fl. 313; Henk. and Hochst. Nadelh. 21; Nelson, Pinac. 127; Gray, Man. N.U. States, ed. 5, 469; Hoopes, Evergreens, 98; Parl. in DC. Prodr. xvi. 2, 379; Koch, Dendr. ii. 2, 304; Vasey, Cat. Forest Trees, 30; Meehan in Rep. Perm. Fruit Growers' Soc. 1877, and t.; Engelm. in Trans. St. Louis Acad. iv. 183; Veitch, Man. Conif. 158; Beissn. Nadelh. 214.

Habitat.—Alleghany Mountains, Pennsylvania to Tennessee.

A tree 30-60 feet in height, with a trunk 2-3½ feet in diameter; most common, and reaching its greatest development, upon the high mountains of East Tennessee; here often the prevailing species, and forming extensive forests (C. S. Sargent).

A specimen of *P. pungens*, planted in 1878, now measures 12 feet 6 inches in height, with a girth of 8 inches.

It has produced cones in Denmark.

P. pyrenaica, Lapeyr. Arb. Pl. Pyren. 146, and Suppl. 63; Loud. Arbor. Brit. iv. 2209, f. 2090-93, and Encycl. of Trees, 961, f. 1779-80; Ant. Conif. 3, t. 3, f. 4; Lindl. and Gord. Journ. Hort. Soc. v. 219; Endl. Syn. Conif. 180; Knight, Syn. Conif. 27; David, Rev. Hort. 1852, 416; Carr. Tr. Gén. des Conif. 391; Gord. Pinet. 182; Veitch, Man. Conif. 156; Beissn. Nadelh. 225. *Pinaster hispanicus*, Clus. Hist. pl. 33. *P. halepensis major*, Ann. Soc. Roy. d'Hort. Par. 1838, 186. *Pinaster hispanica*, Roxas di San Clemente. *P. Brutia*, Ten. Syn. 47, and Fl. Nap. v. 266, t. 200. *P. Loiseleuriana*, Carr. Conif. ed. 2, 500. *P. Pallasii*, Paol. H. Bot. Parol. 1841, 3. *P. Paroliniana*, Webb. Herb. *P. Parolini*, Wis. Illust. delle Piante Nuov. Mem. iii. 7, t. 1. *P. hispanica*, Cook, Sketches in Spain, ii. 337. *P. penicillus*, Lapeyr. Hist. Pl. Pyren. 63.

Habitat.—The Pyrenees, chiefly on the Spanish side; also in many places on the sierras stretching across the peninsula; in the South of

France, especially in the department of Gers ; and, according to Parlature : "In nemoribus Calabriae ad 2,400-3,000 ped., hinc inde solitaria ; in insula Cypro, insula Creta, frequens in Monte Tauro Caramanico ad 2,500-5,000 ped. ; in Syria et in Bithynia ubi vastas conficit sylvas" (Prodr. xvi. 384).

Introduced into England in 1834 by Captain Cook (afterwards Captain Widdrington).

P. pyrenaica, Lapeyr., has, Professor Schübeler says, done well as young plants at Christiania. At Christiansand (58° 8') it thrives exceedingly well. Professor Schübeler has seen a plant 11 feet high (3·5 mètres). The four top-shoots had together a length of 6 feet. It has also been kept out of doors at Stockholm (Schübeler).

If these plants really belong to the true *Pinus pyrenaica* it is an interesting testimony to its hardiness. As far as I know we have only young plants in Denmark. They have apparently not suffered from winter cold.

P. pyrenaica, Lapeyr., *fide* Parlature (*P. Brutia*, Ten., and with other synonyms), must not be confounded with *P. pyrenaica*, Loud., which is a form of *P. Laricio*, to which it is so closely allied as to be often considered a variety of it ; but the leaves of *P. Laricio* are stouter, and the more numerous ducts are surrounded by strengthening cells, which are very scarce in the leaves of the other. The *Pinus pyrenaica* of English plantations is now generally considered to be this form of the very variable *Pinus Laricio*, or Corsican Pine, and recognisable among other things by the deep orange colour of the young shoots. The name of *pyrenaica* should be strictly confined to *P. pyrenaica*, Lapeyr. This is a tree which, on the authority of Parlature, is a native of the forests of Central and South-eastern Spain, the mountains of Calabria, the islands of Cyprus and Crete, the Caramanian Taurus, Syria, and Bithynia. Not unnaturally, it has received a variety of names, as generally happens when botanists describe a specimen from one locality without having the opportunity of detailed comparison of specimens from other regions.

The tree in question has been confounded with *P. Pinaster* (as in Veitch's Manual), from which it differs considerably, with *P. Laricio*, and with *P. halepensis*. Gay, in a note in the "Kew Herbarium," says it differs from *P. halepensis* in its leaves, which are twice the length of those in *halepensis* ; in the cones, which are oblong, not ovoid ; and in the scales of the cone, which are depressed, not raised in the centre. We may also add that the stems are less glaucous, and the cones are on much shorter stalks, spreading, not deflected, broader at the base, and with flatter apophyses. Lambert, unfortunately, confounded both *halepensis* and *Laricio* under his *maritima*. He subsequently corrected the mistake in part, so that

t. 9, vol. i. ed. 1, folio, represents *Laricio*, though called *maritima*. His t. 10, vol. i., shows a detached cone with prominent apophysis = the *P. halepensis* var. β of Tenore, while the cone on the branch has a flat apophysis, like *Brutia*.

What follows is taken from the "Pinetum Woburnense," p. 27 :—

The Calabrian Pine "bears a strong similarity to the *P. maritima* of Lambert, as well as to the *P. halepensis*, but is readily distinguished from either of these species by its much longer wavy leaves, which vary from 3 to 5 inches in length, whilst those of the above-mentioned species are seldom above half the size. The cones of the *P. Brutia* are also quite (nearly) sessile, growing in large clusters (or singly) surrounding the stem. A splendid figure of this is given in Mr. Lambert's third volume of his 'Genus Pinus,' in which he says that 'Sprengel has even referred it to *P. Pinaster*, not even allowing it the rank of a variety; but no two species can be more distinct. The leaves in *Pinaster* are straight, rigid, twice as stout, and disposed in interrupted verticils; and the cones are double the size, with the scales elevated and angular. The specimen represented in the plate was obligingly communicated to me by the Hon. William T. H. Fox-Strangways, Under-Secretary of State for Foreign Affairs, who received it from Professor Tenore.' It, however, appears to me to be more nearly allied to the *P. halepensis* than to any other of the species. The Woburn collection is indebted for this new and valuable Pine to the Right Hon. the Earl of Mountmorres, who, I believe, was the first that raised it from seed in this country, and kindly sent a couple of plants of it, along with a valuable collection of other plants, to Woburn. It is a native of Calabria (the ancient Brutium), where it attains a considerable size, and produces timber of a very superior quality."

This tree has been highly spoken of for the purposes of reafforesting the Karst and the Adriatic coast (M. T. M. in the *Gardeners' Chronicle*, Sept. 8, 1888, p. 267).

P. reflexa, Engelmann in Gard. Chron. Feb. 25, 1882, 260.
P. flexilis var. *reflexa*, Engelm. in Rothrock's Rep. Bot. Exped. Wheeler.

Habitat.—High mountains of South-western New Mexico (Greene, Rusby), to the Santa Rita Mountains (Rothrock, Engelmann, and Sargent), and Santa Catalina Mountains (Lemmon, Pringle), Arizona.

A tree 80–100 feet in height, with a trunk sometimes exceeding 2 feet in diameter; rocky ridges and slopes of almost inaccessible cañons between 6,000 and 8,000 feet elevation (C. S. Sargent).

Is perhaps not hardy in Denmark.

P. resinosa, Sol. in Ait. Hort. Kew. ed. 1, iii. 367, and ed. 2, v. 316; Lamb. Pin. ed. 1, 27, t. 13, ed. 2, i. 23, t. 15, and ed. 3, i. 17, t. 13; Willd. Spec. iv. 496, Enum. 988, and Berl. Baumz.

267 ; Poir. in Lam. Dict. v. 339 ; Pers. Syn. ii. 1578 ; Desf. Hist. Arb. ii. 612 ; Smith in Rees' Cycl. xxviii. No. 3 ; Pursh, Fl. Am. Sept. ii. 642 ; Eaton, Manual, 110, and ed. 6, 264 ; Nutt. Gen. ii. 223 ; Hayne, Dend. Fl. 173 ; Spreng. Syst. ii. 886 ; Torr. Compend. Fl. N.U. States, 360 ; Fl. N. York, ii. 227 ; Beck, Bot. 339 ; Loud. Arbor. iv. 2210, f. 2094-97 ; Forb. Pinet. Wob. 19, t. 6 ; Hook. Fl. Bor. Am. ii. 161, in part ; Eaton and Wright, Bot. 358 ; Bigelow, Fl. Boston. ed. 3, 384 ; Lindl. in Penn. Cycl. xvii. 170 ; Ant. Conif. 7, t. 4, f. 1 ; Link in Linnaea, xv. 501 ; Endl. Syn. Conif. 178 ; Knight, Syn. Conif. 27 ; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 219 ; Parry in Owen's Rep. 618 ; Carr. Tr. Gén. Conif. 401 ; Gord. Pinet. 183 (excl. syn. *Loisleuriana*), and ed. 2, 256 ; Richardson, Arctic Exped. 441 ; Cooper in Smithsonian Rep. 1858, 257 ; Wood, Cl. Book, 661, and Bot. and Fl. 313 ; Henk. and Hochst. Nadelh. 45 (excl. syn. *Loisleuriana*) ; Sargent, Forest Trees of N. Amer. 191 ; Hoopes, Evergreens, 102 ; Gray, Man. N.U. States, ed. 5, 470 ; Parl. in DC. Prodr. xvi. 2, 388 ; Koch, Dendr. ii. 2, 286 ; Vasey, Cat. Forest Trees, 30 ; Macoun in Geolog. Rep. Canada, 1875-76, 211 ; Engelm. in Trans. St. Louis Acad. iv. 179 ; Sears in Bull. Essex Inst. xiii. 185 ; Bell in Geolog. Rep. Canada, 1879-80, 50 ; Veitch, Man. Conif. 159 ; Beissn. Nadelh. 246. *P. rubra*, Michx. fil. N. Amer. Sylv. iii. 112, t. 134.

Habitat.—Newfoundland ; northern shores of the Gulf of St. Lawrence and Lake Nipigon to the valley of the Winnipeg River ; south through the Northern States to Chestnut Hill, Middlesex County, Massachusetts, the mountains of Northern Pennsylvania, Isabella County, Michigan, and Central Minnesota.

According to Michaux, in America it rises from 70 to 80 feet, with a trunk about 2 feet in diameter, and retaining nearly the same bulk for two-thirds of its height. The bark is of a clearer red than that of any other Pine in the United States, and by this the tree may always readily be distinguished. The leaves are 5 or 6 inches long, of a dark green, two in a sheath, and collected in bunches at the extremities of the branches, like those of the Pinaster, instead of being distributed regularly over them, like those of *P. inops* and *P. silvestris* (J. C. Loudon, Arb. et Frut. Brit. 1814, iv. 2211).

This is an elegant tree when young. Michaux, seeing its trunk covered with red bark, called it *P. rubra*, a name it has still kept in some places.

Wood light, not strong, hard, rather coarse-grained, compact ; bands of small summer cells broad, dark-coloured, very resinous, resin passages few, small, not conspicuous ; medullary rays numerous, thin ; colour light red, the sapwood yellow or often almost white ; specific gravity, 0.4854 ; ash, 0.27 ; largely manufactured into lumber and used for all purposes of construction, flooring, piles, &c.

A large tree, 80-85 feet in height, with a trunk 2-4½ feet in

diameter; light, sandy loam or dry, rocky ridges, forming scattered groves rarely exceeding a few hundred acres in extent; common, and reaching its greatest development, through Northern Wisconsin and Minnesota; rare in the Eastern States, except in the extreme northern portions of New England (C. S. Sargent).

P. resinosa is rare in Denmark. A plant twenty-two years old has reached a height of more than 25 feet, and a girth of more than 2 feet.

P. rigida, Mill. Dict. ed. 7, n. 10; Du Roi, Harbk. ii. 60; Marshall, Arb. 101; Wangenh. Amer. 41; Lamb. Pin. ed. 1, i. 25, t. 18, 19, ed. 2, i. 32, t. 16, 17, and ed. 3, i. 28, t. 18, 19; Willd. Spec. iv. 498, Enum. 988, and Berl. Baumz. 268; Pers. Syn. ii. 578; Desf. Hist. Arb. ii. 612; Michx. fil. Hist. Arb. Am. i. 89, t. 8, and N. Amer. Sylv. ed. 3, iii. 118, t. 144; Nouv. Duham. v. 244, t. 74; Ait. Hort. Kew. ed. 2, v. 317; Smith in Rees' Cycl. xxviii. No. 14; Pursh, Fl. Am. Sept. ii. 643; Poir. Suppl. iv. 417; Eaton, Manual, 110, and ed. 6, 265; Barton, Compend. Fl. Philadelph. ii. 183; Nutt. Gen. ii. 223; Hayne, Dend. Fl. 175; Elliott, Sk. ii. 635; Spreng. Syst. ii. 887; Torr. Compend. Fl. N.U. States, 360, and Fl. N. York, ii. 227; Beck, Bot. 339; Loud. Arbor. iv. 2239, f. 2123-26; Forb. Pinet. Wob. 41, t. 13; Eaton and Wright, Bot. 358; Ant. Conif. 26, t. 7, f. 2; Bigelow, Fl. Boston. ed. 3, 385; Lindl. in Penn. Cycl. xvii. 172; Link in Linnæa, xv. 503; Spach, Hist. Vég. xi. 388; Griffith, Med. Bot. 604; De Chamb. Arb. Résin. 31; Endl. Syn. Conif. 164; Knight, Syn. Conif. 30; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 217; Carr. Tr. Gén. Conif. 342, and ed. 2, 447; Darlington, Fl. Cestrica, ed. 3, 290; Darby, Bot. S.U. States, 514; Gord. Pinet. 207, and ed. 2, 283; Cooper in Smithsonian Rep. 1858, 257; Chapman, Fl. S.U. States, 433; Curtis in Rep. Geolog. Surv. N. Carolina, 1860, iii. 21; Wood, Cl. Book, 660, and Bot. and Fl. 313; Henk. and Hochst. Nadelh. 67; Nelson, Pinac. 128; Gray, Man. N.U. States, ed. 5, 469; Hoopes, Evergreens, 119; Parl. in DC. Prodr. xvi. 2, 394; Koch, Dendr. ii. 2, 307; Vasey, Cat. Forest Trees, 31; Engelm. in Trans. St. Louis Acad. iv. 183; Sears in Bull. Essex Inst. xiii. 186; Veitch, Man. Conif. 169; Beissner, Nadelholzk. 266. *P. Taxa rigida*, Ait. Hort. Kew. ed. 1, iii. 368. *P. Fraseri*, Lodd. Cat. 1836. *P. Loddigesi*, Loud. Arb. Brit. iv. 2269.

Habitat.—Valley of the St. John's River, New Brunswick, to the northern shores of Lake Ontario; south through the Atlantic States to Northern Georgia, extending to the western slope of the Alleghany Mountains in West Virginia and Kentucky (Pineville, Bell County, De Friese).

A tree 40-80 feet in height, with a trunk 2-3 feet in diameter; dry, sandy, barren soil, or less commonly in deep, cold swamps; very common.

Wood light, soft, not strong, brittle, coarse-grained, compact;

bands of small summer cells broad, very resinous, conspicuous, resin passages numerous, not large; medullary rays numerous, obscure; colour light brown or red, the thick sapwood yellow, or often nearly white; specific gravity, 0.5151; ash, 0.23; largely used for fuel, charcoal, and occasionally manufactured into coarse lumber (C. S. Sargent, "Forest Trees of North America"). Upon the island of Nantucket, Massachusetts, this species is now greatly injured by the attacks of the destructive caterpillar of the pine moth, *Retina frustana* (Scudder in Pub. Mass. Agric. Soc. 1883, and t.).

This species seems to have formerly abounded in Connecticut, Massachusetts, and New Hampshire, for from the beginning of the eighteenth century till 1776 these States furnished Britain with a considerable quantity of tar. About the year 1705—a misunderstanding having taken place between Great Britain and Sweden, from which latter country the British Government had principally drawn its supply of tar—Great Britain encouraged this branch of industry in the northern part of America by a premium of £1 sterling for every barrel of tar made from dead wood, and £2 for every barrel made from green wood; in consequence of which, and of this tree furnishing tar abundantly, its destruction has been so rapid that it is now rarely found in the Northern States. *P. rigida* was cultivated in England by the Duke of Bedford previously to 1759 (J. G. Lemmon, "California Board of Forestry," 1889-90).

In some parts of the Alleghanies, where this tree abounds, houses are built of it, and the wood, if it is not covered with paint, is readily recognised by its numerous knots. It is thought better than the Yellow Pine for floors that are frequently washed, as the resin with which it is impregnated renders it finer and more durable. It is used for ship pumps, and as fuel by the bakers and brick-makers of New York and Philadelphia; and from the roots is prepared lampblack. The principal use of this tree is, however, to furnish tar and turpentine. The essence of turpentine, used in most parts of America for painting, is obtained from this tree.

Dr. Mayr says in his book, "Die Waldungen von Nord-Amerika," that *P. rigida* is hardly more resinous than other Firs, and that as a substitute the wood of *P. mitis* and *P. resinosa* is also called "Pitch Pine." He draws attention to the great error of falsely calling the excellent wood of the Yellow Fir (*P. australis*) pitch pine, although it is not so called in America. This mistake has caused the planting of large numbers of *P. rigida* as "Pitch Pine." Dr. Mayr believes that this species can only be recommended for planting on sandy hills near the sea-coast.

A tree of this species planted in 1864 in Denmark now measures 36 feet in height and 2 feet 9 inches in girth.

P. Russelliana, Lindl. Bot. Reg. 1839, app. 63; Spach, Hist. Vég. Phan. xi. 402; Loud. Encycl. of Trees, 1003, f. 1879-80; Endl.

Syn. Conif. 152 ; Lindl. and Gord. Journ. Hort. Soc. v. 215 ; Knight, Syn. Conif. 33 ; Carr. Traité Gén. des Conif. 314 ; Gord. Pinet. 238 ; Henk. and Hochst. Syn. der Nadelholzk. 105 ; J. E. Nelson, Pinac. 128.

Habitat.—On the highest points of “Carmen,” in Mexico. Hartweg discovered it on the way from San Pedro to San Pablo, near Real del Monte.

Introduced into Europe in 1839.

We have not yet obtained the plant in Denmark, but I have cones in my collection.

P. Sabiniana, Dougl. in Companion to Bot. Mag. ii. 150 ; Lamb. Pin. ed. 1, iii. 137, t. 58 ; Loud. Arbor. iv. 2246, f. 2138-43 ; Forb. Pinet. Wob. 63, t. 23, 24 ; Hook. Fl. Bor. Am. ii. 162 ; Lindl. in Penn. Cycl. xvii. 172 ; Ant. Conif. 30, t. 11 ; Hook. and Arnott, Bot. Beechey, 393 ; Link in Linnæa, xv. 509 ; Nutt. Sylv. iii. 110, t. 113, and ed. 2, ii. 169, t. 113 ; Spach, Hist. Vég. Phan. xi. 390 ; De Chambray, Tr. Arb. Rés. 347 ; Endl. Syn. Conif. 159 ; Knight, Syn. Conif. 30 ; Lindl. and Gord. in Journ. Hort. Soc. Lond. v. 216 ; Fl. des Serres, ix. 275, t. 964 ; Carr. Tr. Gén. Conif. 334, and ed. 2, 435 ; Torr. and Gray in Pacific R.R. Rep. ii. 130 ; Bigelow in Pacific R.R. Rep. iv. 25 ; Torr. in Pacific R.R. Rep. iv. 141, Bot. Mex. Boundary Surv. 210, t. 57, and Ives' Rep. 28 ; Newberry in Pacific R.R. Rep. vi. 39, 90, f. 13 ; Gord. Pinet. 208, and ed. 2, 284 ; Cooper in Smithsonian Rep. 1858, 261 ; Walpers, Ann. v. 799 ; Bolander in Proc. Calif. Acad. iii. 226, 318 ; Henk. and Hochst. Nadelh. 75 ; Lawson, Pinet. Brit. i. 85, t. 11, f. 1-3 ; Nelson, Pinac. 129 ; Hoopes, Evergreens, 121 ; Parl. in DC. Prodr. xvi. 2, 391 ; Fowler in Lond. Gard. Chron. 1872, 1326 ; Koch, Dendr. ii. 2, 312 ; Vasey, Cat. Forest Trees, 31 ; Engelm. in Wheeler's Rep. vi. 375, Trans. St. Louis Acad. iv. 182, and Bot. Calif. ii. 127 ; Veitch, Man. Conif. 169.

Habitat.—California, Portuguese Flat, Shasta County ; south along the foot-hills of the coast ranges and the western slope of the Sierra Nevada, below 4,000 feet elevation.

A large tree, 80-100 feet in height, with a trunk 2-4 feet in diameter ; very common through all the foot-hills region (C. S. Sargent, “Forest Trees of North America”).

Mr. Muir, in an article in *Harper's Magazine* on the coniferous forests of the Sierra Nevada, gives the following account of this tree, which for its interest is worth transcribing : “The first coniferous tree met by the traveller in ascending the range from the west is the Nut Pine, remarkable for its loose, airy, tropical appearance, suggesting a region of Palms rather than cool rising Pine woods. No one would take it at first sight to be a Pine or Conifer of any kind, it is so loose in habit and so widely branched, and its foliage is so thin and grey. Full-grown specimens are from 40 to 50 feet in height, and from 2 to

3 feet in diameter. At a height of 15 or 20 feet from the ground the trunk usually divides into three or four main branches, about equal in size, which, after bearing away from one another, shoot straight up and form separate summits, while the crooked subordinate branches aspire, or radiate, or droop in loose ornamental sprays. The slender, greyish-green needles are from 8 to 12 inches long, loosely tasselled, and incline to droop in handsome curves, contrasting with the stiff, dark-coloured twigs and branches in a very striking manner. No other tree of my acquaintance, so substantial in body, is in its body so thin and so pervious to light. The sunbeams sift through even the leafiest trees with scarcely any interruption, and the weary, heated traveller finds but little protection in the shade. It grows only on the torrid foot-hills, seeming to delight in the most ardent sun-heat, like a Palm, springing up here and there singly, or in scattered groups of five or six, among shrubby white Oaks and thickets of *Manothus* and *Manganita*, its extreme upper limit being about 4,000 feet above the sea, its lower about from 500 to 800 feet. The general crop of sweet nutritious nuts (seeds) which it yields makes it a great favourite with Indians and with bears. The cones are truly magnificent, measuring 5 to 8 inches in length, and not much less in thickness; rich chocolate-brown in colour, and protected by strong, curved hooks, which terminate in scales. Nevertheless, the *Red* Douglas squirrel can open them.

"Indians gathering the ripe nuts make a striking scene. The men climb the trees like bears and beat off the cones with sticks, or recklessly cut off the more fruitful branches with hatchets, while the squaws gather them in heaps, and roast them until the scales open sufficiently to allow the hard-shelled seeds to be beaten out. Then, in the cool evenings, men, women, and children, with their capacity for dirt greatly increased by the soft resin with which their hands are all bedraggled, form circles around the camp-fires on the banks of some stream, and lie in easy independence, cracking nuts, and talking and chatting, as heedless of the future as bears and squirrels.

One plant, about sixteen years of age, was killed in the winter of 1890-91, but it was not a healthy or well-cultivated specimen.

The species may be hardy.

P. serotina, Michaux, Fl. Bor. Amer. ii. 205; Pinet. ed. 1, i. t. 19; Pinet. Woburn. 47, t. 16; Link in Lindl. and Gord. Journ. Hort. Soc. v. 217; Knight, Carr. Tr. Gén. Conif. 341; Gord. Pinet. 209; Henk. *P. rigida* var. *serotina*, Engelm. Revis. of the Genus *Pinus*, p. 183; Loud. Encycl. of Trees, 979, f. 1824-27. *P. Texana*, Ait. Hort. Kew. ed. 1, v. 317.

Habitat.—North Carolina; south, near the coast, head of the St. John's River, Florida.

A tree 40-80 feet in height, with a trunk 2-3 feet in diameter;

inundated borders of streams and ponds in low peaty soil; not common.

P. silvestris, Linn. Spec. Pl. 1418 (excl. var.); Lamb. Pinet. ed. 2, i. t. 1; Rich. Conif. t. 11; Loud. Arbor. iv. 2153, f. 2043-44; Ant. Conif. 9, t. 4, f. 3; Schouw, Ann. Sc. Nat. ser. 3, iii. 331; Spach, Hist. Vég. Phan. xi. 376; De Cand. Fl. Fr. iii. 271; Desf. Hist. Arbr. ii. 610; De Chambr. Tr. Prat. Arbr. Résin. 142, pl. 1, f. 78, and pl. 5, f. 2; Endl. Syn. Conif. 171; Lindl. and Gord. Journ. Hort. Soc. v. 218; Knight, Syn. Conif. 26; Carr. Tr. Gén. des Conif. 372; Gord. Pinet. 184; Veitch, Man. Conif. 156; Beissner, Nadelholzk. 225. *Tæda*, Plin. Hist. Nat. xvi. 19. *Pinaster vulgaris* prior, Clus. Pannon. 16. *P. silvestris vulgaris genevensis*, J. Bauh. Hist. 1, 2, 253. *P. silvestris*, C. Bauh. Pinet. 491. *P. silvestris scariosa*, Lodd. *P. silvestris squamosa*, Bosc. *P. rubra*, Mill. Dict. n. 3. *P. silvestris rigensis*, hort. *P. rigensis*, Desf. Cat. Hort. Par. Abr. ii. 61.

Habitat.—Central and Northern, and even parts of Southern Europe, such as Spain, and the Siberian forest region as far as the Amour River. It is not now found growing wild in Denmark.

A tree of this species lately measured in a Danish garden gave a height of 60 feet and a circumference of 4 feet 2 inches; it was planted in 1845. Trees exceeding 70 feet are to be seen in plantations.

In reference to the height of this species Prof. Schübeler says: "The grandest and finest trees, wherever they can be found, are cut down to be used as masts; but even in the South of Norway it is difficult enough to find a Pine that has a height of 100 feet or more. Two such trees, which are to be found in Lower Telemarken (59° 16' N. and 6° 55' E.), were measured in November 1872. One specimen was found to have a height of 104 feet, with a diameter at the base of 34 inches; the other had a height of 105 feet, and at 96 feet from the ground the trunk had a diameter of 5 inches. The first-mentioned tree, at the height of 40 feet, had a diameter of 16 inches; at 50 feet, 14½ inches; at 60 feet, 12 inches; and at 70 feet, 9½ inches. The other tree had similar dimensions. The diameters are counted without the bark."

P. s. monophylla, Hodgins (the One-leaved Scotch Fir).

The leaves of this variety are attached to each other throughout their length, and have the appearance of being united, but by giving them a twist they separate into two, like the ordinary Scotch Fir. It is a very singular variety.

P. s. variegata, hort. (the Variegated Scotch Fir).

This only differs from the ordinary form in the mixture of its pale straw-coloured with the usual glaucous- or bluish-green leaves being produced on both old and young wood.

P. Strobis, Linn. Sp. Pl. 1419, and Syst. ed. Reich. iv. 174; Mill. Dict. n. 13; Hunt. Evel. Syl. 263; Wangenh. Beitr. i. t. 1, f. 1;

Vitm. Sp. Pl. v. 345; Ait. Kew. iii. 369; Du Roi, Harbk. ed. Pott. ii. 78; Marsh. Arb. Amer. 101; Poir. Dict. v. 341; Lamb. Pin. ed. 2, i. t. 32; Nouv. Duham. v. 249; Pursh, Fl. Amer. Sept. ii. 644; Hayne, Dend. 176; Laws. Manual, 360; Loud. Arb. Brit. iv. 2280, f. 2193-96; Pinet. Wob. 83; Gord. Pinet. i. 239, and ii. 295; Carr. Tr. Gén. Conif. i. 302, and ii. 399; Henk. and Hochst. Syn. 92; Beissn. Nadelh. 288. *P. foliis quinis, cortice glabro*, Gron. Virg. ii. 152. *P. foliis longissimis ex una theca quinis*, the White Pine, *nostratibus*, Colden, Nov. Ebor. n. 229 in Act. Upsal. 1743. *P. canadensis quinquefolia, floribus albis*, &c., Duham. Arb. ii. 127. *P. virginiana, conis longis, non ut in vulgari echinatis*, Pluk. Alm. 297. *Larix canadensis*, &c., Tourn. Inst. 586. *Strobus americana*, A. S. Oersted, Frilands-Trövöxten i Danmark, 1864, 80.

Habitat.—Newfoundland, northern shores of the Gulf of St. Lawrence to Lake Nipigon and the valley of the Winnipeg River; south through the Northern States to Pennsylvania, the shores of Lake Michigan, "Starving Rock," near La Salle, Illinois, near Davenport, Iowa (Parry), and along the Alleghany Mountains to Northern Georgia.

Introduced into England in 1705, and has there got its most common name—after Lord Weymouth, who a short time after its introduction planted a great number of trees on his property at Longleat, in Wiltshire (F. C. Schübeler, "Viridarium Norvegicum," i. 392, 1886). *P. Strobus* received its name from Linneus, and was, as Loudon says, first cultivated in England by the Duchess of Beaufort at Badminton, in 1705, and great quantities were soon afterwards planted at Longleat.

A large tree of the first economic value, 80-170 feet in height, with a trunk 4-12 feet in diameter; sandy loam upon drift formations, forming extensive forests, or in the region of the great lakes often in small bodies scattered through the hard-wood forests, here reaching its greatest development; north of latitude 47° N. and south of Pennsylvania, Central Michigan, and Minnesota much smaller, less common and valuable (C. S. Sargent).

Pinus Strobus is found in highest perfection in the extensive territory comprehended between 42° and 45° north latitude. Within this space lie large portions of the provinces of New York, New England, Nova Scotia, and Canada. The principal woods are on the shores of Fundy Bay and of Canso Bay (in Nova Scotia); on the eastern side of Massachusetts Bay; on the shores of the rivers Piscataqua and Merrimac (in New Hampshire), and of the Connecticut and Mohawk; and from the extreme northern side of the river St. Lawrence towards Montreal and the shores of Lake Champlain. In the more southerly parts of North America this species appears but sparingly, and never in continued forests—a proof that a cold, rough climate suits it best. The soil in which this Pine is found is said to be of the

best kind, being a clay mixed with sand and other earths ; it is light and moist, preserving these qualities to the depth of some feet. The valleys, the crevices of the mountains, and banks of rivers are the storehouses, as it were, into which the rains and melted snows in the spring carry down the fattest parts of the soil of the higher lands.

The wood of this species is more employed in America than that of any other Pine. Throughout the Northern States, at the time the younger Michaux published his "North American Sylva" (1819), seven-tenths of the houses, except in the larger capitals, were of wood, and about three-quarters of these were built almost entirely of White Pine ; and even in the cities the beams and principal woodwork of the houses were of this wood. "The ornamental work of the outer doors, the cornices and friezes of apartments, and the mouldings of fireplaces, all of which in America are elegantly wrought, are of this wood. It receives gilding well, and is, therefore, selected for looking-glass and picture frames. Sculptors employ it exclusively for the images that adorn the bows of vessels, for which they prefer the kind called the Pumpkin Pine. At Boston, and in other towns of the Northern States, the inside of mahogany furniture and of trunks, the bottoms of Windsor chairs of an inferior quality, water-pails, a great part of the boxes used for packing goods, the shelves of shops, and an endless variety of other objects are made of White Pine. In the district of Maine it is employed for barrels to contain salted fish, especially the kind called the Sapling Pine, which is of a stronger consistence. For the magnificent wooden bridges over the Schuylkill at Philadelphia and the Delaware at Trenton, and for those which unite Cambridge and Charlestown with Boston, of which the first is 1,500 feet, and the second 3,000 feet in length, the White Pine has been chosen for its durability. It serves exclusively for the masts of the numerous vessels constructed in the Northern and Middle States, and for this purpose it would be difficult to replace it in North America. The principal superiority of White Pine masts over those brought from Riga is their lightness, but they have less strength, and are said to decay more rapidly between decks and at the point of intersection of the yards. This renders the Long-loaved Pine (*P. australis*) superior to the White Pine, in the opinion of the greater part of the American shipbuilders ; but some of them assert that the White Pine would be equally durable if the top were carefully protected from the weather. With this view, an experiment has been suggested, of a hole, several feet deep, made in the top of the mast, filled with oil and hermetically sealed ; the oil is said to be absorbed in a few months. The bowsprits and yards of ships-of-war are of this species. The wood is not resinous enough to furnish turpentine for commerce" (J. C. Loudon, "Arboretum").

Michaux states that *P. Strobus* grows in America to the height of

from 100 to 180 feet, with a straight trunk of from 4 to 6, or even 7 feet in diameter.

In England *P. Strobus* is fast coming to the front, not only as an ornamental, but as a valuable timber-producing tree; indeed, whether viewed from an economic or ornamental aspect, it must be considered as one of the most valuable Pines that have yet been introduced. A comparison of the wood produced by the Weymouth Pine in this country and that sent to the Colonial and Indian Exhibition revealed but slight differences, and nothing more than would naturally be expected between a mature and a partially-developed tree. The rapidly approaching extinction of this tree is at present causing much anxiety to those who are interested in the timber supplies of America, and is owing partly to the reckless and improvident felling carried on under the impetus of speculation. With such a state of things abroad, it is to be regretted that greater numbers of this Pine are not planted in suitable soils and situations in the British Isles, for that there are vast tracts of almost worthless land that is well suited for its culture is beyond a doubt. I do not wish it to be inferred from anything here said that the Weymouth Pine is suitable for planting at high altitudes and in exposed situations, for such has been long ago proved to be a fallacy; but that it will grow rapidly and produce useful timber in partially sheltered districts has been proved on various occasions by those who have paid particular attention to the value of exotic Conifers as profitable timber-producers in this country. The Weymouth Pine has much to recommend it to the British arboriculturist, for besides the great quantity of valuable timber it produces, it certainly is the handsomest of the genus that has been found to be perfectly hardy in these isles. Its form is light and elegant, and the silvery glaucous leaves afford a distinct and pleasing contrast to the majority of the cultivated Pines. Whether grown as a plantation tree, or singly for purely ornamental purposes, the stem is always straight and clean, and the branches evenly distributed. The Weymouth Pine is a tree of very rapid growth, numerous specimens (of which I have kept a record) having attained to an average height of 57 feet in thirty years (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

This species has in some parts of Denmark, at the age of about sixty years, attained a height of 80 feet; while others, planted in 1845, are 47 feet high, with a circumference of stem of 2 feet 8 inches.

P. Strobus has been planted on many parts of the coast of Norway as far north as Drontheim (Trondhjem, 63° 26'), where it succeeds very well, and probably it would thrive even farther north.

The largest specimen to be found in Norway is to be seen near Christiania, at Bogstad. It was planted nearly a hundred years ago, and is now about 80 feet in height, with a circumference of more than 6 feet.

Near Stockholm, in the park of the Royal Castle, Drottningholm, several grand trees of this species are to be found. When paying a visit there I had no opportunity of measuring them exactly, but observed that I could not reach more than about half-way round the stems with my arms. Some of these trees are most likely of similar dimensions to the above-mentioned tree in Norway.

P. S. nivea, Knight, the White Weymouth or Snow Pine. *P. S. alba*, Loud. *Encycl. of Trees*, 1018. *P. nivea*, Booth, ex Knight, *Syn. Conif.* 34. *P. Strobilus argentea*, hort.

This variety differs from the species in having the leaves erectly spreading, more dense, and of a very dark green colour when fully grown, but when young of a silvery white on the upper surface.

This kind bears considerable resemblance to *P. monticola*, but the leaves are less dense on the shoots, and much slenderer; the cones are narrower, and of a bright green colour when young, while those of *P. monticola* are of a dull purple.

P. Tæda, Linn. *Spec.* 1419; Du Roi, *Harbk. Baumz.* ii. 63; Wangenh. *Beitr.* 1787, 41; Lamb. *Pin. ed. 1*, i. 23, and *ed. 2*, i. 30; Desf. *Hist. Arb.* ii. 612; Michaux fils, *Arbr. For. de l'Amer.* i. 97; Ait. *Hort. Kew.* iii. 368; Willd. *Baumz.* 269; Loisel. *Nouv. Duham.* v. 245; Lawson, *Agric. Manual*, 351; Loud. *Arbor. Brit.* iv. 2237, f. 2118-22, and *Encycl. of Trees*, 976, f. 1816-19; Forb. *Pinet. Wob.* 43, t. 14; Ant. *Conif.* 25; Link in *Linnaea*, xv. 503; Spach, *Hist. Nat. Vég. Phan.* xi. 391; Endl. *Syn. Conif.* 164; Lindl. and Gord. in *Journ. Hort. Soc.* v. 217; Knight, *Syn. Conif.* 30; Lawson, *Abiet.* 34; Gord. *Pinet.* 210, and suppl. 67; Oersted, *Frilands-Trövöxten i Danmark*, 1864, i. 77. *P. virginiana tenuifolia*, Pluk. *Almag. Bot. Phyt.* 297. *P. foliis longissimis*, Colden, *Nov. Ebor. in Act. Soc. Upsal.* p. 1743, n. 230. *P. foliis ternis*, Gronov. *Fl. Virgin.* 1762, ed. 2, 152.

A tree 80-85 feet in height, with a trunk 3-5 feet in diameter; low, wet clay or dry sandy soil, springing up on all abandoned lands from Virginia southward, and now often replacing in the southern Pine-belt the original forests of *P. palustris*; in eastern North Carolina rarely on low, rich swamp ridges—here known as "Rosemary Pine," and attaining its greatest development and value (C. S. Sargent, "Forest Trees of North America").

It is one hundred years since this species was described by Linnaeus, and there is no reason to doubt that it was recognised and described by botanists as long as seventy years before that date. It was not, however, brought to England until 1713, when Bishop Compton introduced it. It is doubtless to that period, or not long after, that the fine specimens at Syon House and Pains Hill are to be referred. One of the latter, Loudon says, is doubtless the handsomest tree of the species in Europe. Others at Kew and Whitton belong to a somewhat later period ("Pinetum Britannicum").

I am still in some doubt whether we have this plant in Denmark or not. One plant (still to be verified) is perhaps this species.

P. Teocote, Cham. and Schlecht. in *Linnaea*, v. 76, and xii. 487 ; Lamb. Pinet. ed. 2, i. 37, t. 20 ; Loud. Arbor. iv. 2266, f. 2173-74, and *Encycl. of Trees*, 991, f. 1852-54 ; Ant. Conif. 35, t. 16, f. 3 ; Link in *Linnaea*, xv. 505 ; Spach, *Hist. Vég. Phan.* xi. 400 ; Endl. Syn. Conif. 156 ; Lindl. and Gord. Journ. Hort. Soc. v. 21 ; Knight, Syn. Conif. 30 ; Carr. Man. des Pl. iv. 351, and Tr. Gén. Conif. 328 ; Gord. Pinet. 211 ; Henk. and Hochst. Syn. der Nadelh. 83 (excl. syn.).

Habitat.—Mexico, on the sides of Orizaba, between Cruzblanca and Jalacingo ; also between Angangueo and La Ventilla, and at Real del Monte. Hartweg found it at Ocotillo.

Introduced into Europe in 1839.

We do not possess living plants of it in Denmark, but I have cones in my collection.

P. Thunbergii, Parl. in DC. Prodr. 388 ; Franch. and Savat. Enumer. 464 ; Masters, Linn. Journ. xviii. 504 ; Descrip. Cat. 245 ; Luerksen, Zeitschrift für Forst. und Jagdw. 275, 1. *P. Massoniana*, Lamb. Pinet. ; Carr. Tr. Gén. Conif. i. 378, 73, and ii. 478 ; Veitch, Gard. Chron. ; Henk. and Hochst. Syn. der Nadelh. 13, 28 ; Miquel, Prolusio Fl. Jap. 330, 2 ; Koch, Dendr. ii. 282, 5 ; Nippon Chumokuschi, 6 ; Veitch, Man. Conif. 148 ; Rein, Jap. ii. 281, 28 ; Sieb. and Zucc. Fl. Jap. ii. 24, 113 ; Endl. Syn. Conif. 174 ; Murr. Pines and Firs of Jap. 23 ; Hoopes, Evergreens ; Le Japon à l'Expos. Univer. 109, 10 ; Gord. Pinet. 241. *P. Pinaster*, Loud. Arbor. Brit. 2218 ; Gord. Pinet. 176. *P. silvestris*, Thunb. Fl. Jap. 274. *P. rubra*, Sieb. Syn. Plant. Econ. ii. *P. Cavendishiana*, Paxt. Flower Gard. *P. tabulaformis*, Fortune.

Habitat.—Most parts of Japan, but especially near the coast. In some works it is mentioned that this species also belongs to China, but Dr. H. Mayr considers it doubtful whether this Pine is to be found in China.

Seems to be hardy.

The following extract from Siebold's "Flora Japonica" gives a highly interesting description of a practice peculiar to Japanese horticulture, which appears to have been in vogue for many years, probably for centuries past : "The art of the Japanese gardener has exhausted itself in the cultivation of this Pine and *Pinus densiflora*. They clip and cut them in all manner of ways ; they stretch out the branches like a fan, upon horizontal espaliers, or give to the branches the form of a flat plate. In that artificial culture extremes meet—surprise is equally sought to be gained by specimens of immense extent as by others reduced to the most minute dimensions." During Siebold's sojourn at Osaka he went to see the celebrated Pine before the Naniwaja Tea-house, of which the branches, artificially extended, have a circuit of 135 paces. Another remarkable instance of this artificial cultivation was seen by

Mr. Maries at Lake Bi-wa, near Kioto, in Nippon. The main trunk of the tree is 28 feet in circumference. At about 10 feet from the ground this divides into three primary branches, which have been made to spread out horizontally, and the circular space covered by them and their appendages is fully 60 yards in diameter. On the other hand, they showed him, in Jeddo, a dwarf tree in a lacquered box of which the branches did not occupy more than 2 square inches.

The wood of *P. Thunbergii* is resinous, tenacious, and durable; it is chiefly used in the construction of buildings. The Japanese also make charcoal of it. The soot which they procure from it by burning its resinous roots with the oil of the turnip (*Brassica orientalis*) is said to be employed in making the famous Chinese ink, which is manufactured principally in the convent of Nara, in the province of Janato.

P. Torreyana, C. Parry. Carr. Tr. Gén. Conif. 326; Henk. and Hochst. Syn. der Nadelh. 117 (not J. E. Nelson). *P. Sabiniana microcarpa*, J. E. Nelson. *P. lophosperma*, Lindl. ex Gord. Pinet. Suppl. 69; Henk. and Hochst. Syn. der Nadelh. 112.

Habitat.—California, mouth of the Soledad River, San Diego County; doubtfully reported from one of the islands off Santa Barbara and from Lower California.

A low, short-lived, gnarled, crooked tree, 20-25 feet in height, with a trunk 9-18 inches in diameter; crests of sandy bluffs immediately upon the sea-coast; very local, and fast disappearing (C. S. Sargent, "Forest Trees of North America").

Probably not hardy.

P. tuberculata, Gord. Pinet. ed. 1, 211, ed. 2, 288 (not Don), and Journ. Hort. Soc. iv. 218, and f.; Fl. des Serres, v. 517, and f.; Rep. Oregon Exped. 2, t. 2, f. 2; Henk. and Hochst. Nadelh. 78 (in part); Bolander in Proc. Calif. Acad. iii. 262, 317; Lawson, Pinet. Brit. i. 93, t. 13, f. 1-9; Carr. Tr. Gén. Conif. ed. 2, 441 (in part); Parl. in DC. Prodr. xvi. 2, 394; Koch, Dendr. ii. 2, 309; Vasey, Cat. Forest Trees, 31; Engelm. in Trans. St. Louis Acad. iv. 183, and Bot. Calif. ii. 128; Veitch, Man. Conif. 170; Beissner, Nadelholzk. 270. *P. californica*, Hartw. in Journ. Hort. Soc. ii. 189.

P. tuberculata, Gord. Pinet. ed. 1, 211 (not Don), a name at first erroneously given to a species sent by Jeffrey, is to be retained as now in general use, and because Don's original *tuberculata* is a mere form of *insignis* (Engelm.).

Habitat.—Valley of the Mackenzie River, Oregon; south along the western slope of the Cascade and Sierra Nevada Mountains, and on the Californian coast ranges from the Santa Cruz to the San Jacinto Mountains.

A tree 60-70 feet in height, with a trunk 2-3 feet in diameter, or (rarely) reduced to a low shrub, fruiting when not more than 3 feet

in height; dry, gravelly ridges and slopes from 2,500 (San Bernardino Mountains) to 5,500 (Mount Shasta) feet elevation; not common (C. S. Sargent).

Seems hardy in Denmark.

I have kept some cones of it for more than twenty-five years, and they are not yet opened. I have seen a cone-bearing plant in the Northern Netherlands.

This Pine was first discovered by Dr. Coulter, to the south of Monterey, near the level of the sea, and growing almost close to the beach, intermixed with *P. radiata*. Mr. Hartweg found it growing on the Santa Cruz Mountains, sixty miles to the north of Monterey by land. It is a tree of slow growth, and seldom attains more than 30 feet in height, with a trunk 8 or 10 inches in diameter. Mr. Jeffrey found it at an elevation of 5,000 feet, with the cones adhering to the tree; in several instances with twenty whorls of cones on the trunk, the growth of as many years, the branches being covered with them in the same way as the trunk. The timber is red and hard, and the tree of a conical form, growing about 40 feet high, in poor sandy soil. It is quite hardy (G. Gordon, "The Pinetum," 1875).

P. Winchesteriana, Gord. Journ. Hort. Soc. ii. 158 (*cum ic.*); Lindl. and Gord. *l. c.* v. 215; Knight, Syn. Conif. 33; Carr. Man. des Pl. iv. 351, and Tr. Gén. Conif. 325; Gord. Pinet. 241; Henk. and Hochst. Syn. der Nadelh. 118 (excl. syn. Roetzl); J. E. Nelson, Pinac. 137.

Habitat.—Mexico, where it was found by the Marquis of Winchester, who in 1846 introduced it into Europe. Hartweg found it in great numbers on the Cerro de San Juan near Tepic.

We have not yet acquired any plants, but I have cones in my collection.

31. CEDRUS.—Endl. Conif. 135. *Laricis* sp. Tourn. Inst. 586. *Abietis* sp. Juss. Gen. Pl. 414; Rich. Conif. 147, t. 14, n. 1. *Cedrus*, Link in Linnaea, xv. 537, and pl. Auct.; Parl. in DC. Prodr. xvi. 2, 407; Lamb. Pin. ii. t. 37, and ed. min. t. 51, 52 (*Pinus*); Forb. Pin. Wob. t. 48, 49 (*Pinus*); Hook. fl. in Nat. Hist. Rev. 1862, xi. t. 1-3; Carr. Conif. 366; C. Koch, Dendr. ii. 265; Gord. Pin. 39; Henk. and Hochst. Nadelh. 140; Eichl. in Engl. and Prantl, Natürl. Pflf. ii. s. 74; Willk. Forst. Fl. s. 158; Beissn. Nadelh. 296.

Flowers monœcious; the male catkins solitary, cylindrical, erect, and terminal, female somewhat oval and obtuse, solitary, very rarely in twos, and erect.

Cones oval, obtuse at the ends, quite smooth, erect, and on the upper side of the branches.

Scales very closely placed, rounded on the outer margins, quite thin at the edges, leathery, smooth, and more or less deciduous.

Seeds in twos under each scale, with a soft tegumental covering,

full of turpentine, more or less angular, and furnished with a large persistent membranaceous wing.

Cotyledons mostly nine in number.

Leaves needle-shaped, somewhat four-sided, stiff, persistent, and disposed either in bundles or solitary.

All splendid evergreen trees, found either on Mount Lebanon, in the North of India, or on the Barbary and Atlas Mountains in Northern Africa.

The word "Cedar" ("Kedros" of the Greeks) was not restricted by the ancients to the Cedar of Lebanon, but probably derived from the Arabic "kedr," worth or value, or its derivative "kedrat," strength or power, in allusion to the value of the wood. The Hebrew and Arabic names for the Cedar are "Araz" or "Arz," and that of the Romans "Arar," all from the Arabic root "araza"—"He was firm and stable, with roots deeply fixed in the ground" (Golius). Other writers derive the name from "kaio," to burn, and "drio," to sweat or distil, a kind of incense being obtained from the split wood, and burnt as a substitute for it in the East; Pliny also describes the process of making "cedria" from the Cedar wood by distillation, and affirms its great value as a remedy for toothache, for which cure our modern creosote is therefore but an old remedy revived. Again, others derive the name from Kedron, a brook in Judæa, the Cedar of Lebanon being formerly plentiful along its banks.

In the *Natural History Review* for January 1862, Sir Joseph Hooker, after giving a general description of the three Cedars in their several habitats, observes "that as species the three Cedars cannot be distinguished, and that they must all have been derived from one common stock. It should be added that, besides the differences in habit, habitat, and colour of foliage, there are no other distinctions whatever between them—of bark, wood, leaves, male cones, anthers, or the structure of these, nor in their mode of germination or duration, the girth they attain, or their hardiness. Also that all are very variable in habit; so much so indeed is this the case with the Deodar, which is the most distinct of all in habit, that there are several distinct varieties sold by nurserymen, some as stiff-leaved, others as dark-coloured, and others as short-leaved, as the Lebanon Cedar. Also, that though the differences in the shape of the seeds and scales of Libani and Deodara are very marked, they vary much; many forms of each overlap, and further transition between the most dissimilar may be established by intercalation of seeds and scales from *Cedrus atlantica*."

C. atlantica, Manetti, Cat. Hort. Madoet. suppl. 9. *C. africana*, Gord. Pinet. 39. *C. argentea*, Loud. ex Gord. Pinet. l. c. *C. elegans*, Knight, Syn. Conif. 42. *C. Libani* var. *atlantica*, J. D. Hook. Journ. Bot. 1880; C. Koch, Dendr. ii. 2, 269. *Abies atlantica*, Lindl. and Gord. Journ. Hort. Soc. 1850, v. 214. *Pinus atlantica*,

Endl. Conif. 137. *P. Cedrus γ atlantica*, Parl. in DC. Prodr. xvi. 2, 408.

Habitat.—North Africa, on the highest mountains in Algeria, and particularly on the Atlas, near Tairret, and on the Aurès Mountains at an elevation of 3,250–4,000 feet and more; in thick forests, on the Pic of Tangour, together with some *Cedrus Libani*; and on the Tabor and Tababor Mountains.

Introduced into Europe in 1842.

A noble tree, like the Cedar of Lebanon, growing from 80 to 100 feet high, with horizontal branches and a tabular-shaped head when old, but somewhat pyramidal and open in the head when young.

C. atlantica may be met with in Denmark, aged about twenty-five years, and about 25 feet in height. The glaucous varieties seem to be fully as hardy as the species.

C. a. cinerescens. A most beautiful variety.

C. Deodara, Loud. Arbor. Brit. iv. 2428, f. 2283–86, and Encycl. of Trees, 1059, f. 1975–77; Pinet. Wob. 149, t. 48, 49; Link in Linnæa, xv. 538; Spach, Hist. Nat. Vég. Phan. xi. 430; Hoffm. in Bot. Zeit. 1846, 185; Knight, Syn. Conif. 42; Carr. Tr. Gén. des Conif. 281; Gord. Pinet. 40, and Suppl. 19; Henk. and Hochst. Syn. 141; Beissn. Nadelh. 305. *Pinus Deodara*, Roxb. Fl. Ind. Or. iii. 651. *Abies Deodara*, Lindl. in Penny Cycl. 1833, 9; Lindl. and Gord. in Journ. Hort. Soc. v. 214. *C. indica*, De Chambr. Tr. Prat. des Arb. Résin. 341. *C. Libani*, Barr. var. *Deodara*, Hook. fil. Himal. Journ. i. 257, and in Nat. Hist. Rev. 1861, ii. t. 1–3.

Habitat.—The Himalayan Mountains, in a continuous forest from Afghanistan (about 34° N.) to Nepaul, from longitude 68° to 85° E., at various elevations from 6,500 to 13,000 feet.

Introduced into Great Britain in 1831, by the Hon. W. Leslie Melville, and produced its cones for the first time in Europe in 1858, at Bicton, Devonshire, the residence of the Lady Rolle.

In the Himalayas the Deodar occupies a great vertical belt or range, flourishing from about 5,500 to 12,000 feet of elevation, mixed up for the first 1,500 feet with *Pinus longifolia*, while for the last 3,000 or 4,000 feet it accompanies *Picea Morinda* and *Abies Pindrow*. It is found on all the higher mountains from Nepaul up to Cashmere; and Dr. Griffith describes it as occurring in vast forests and of great size towards Kafirstan, where it is called “Nokhtur,” and flourishes at an elevation of from 6,000 to 10,000 feet above the sea. But to see the Deodar in its greatest perfection, one must visit the snowy ranges and lofty mountains of the interior, far from the influence of the plains, and where for nearly half the year it is enveloped in snow; there its dimensions become gigantic. In Lower Kamaon there is an extensive forest of very fine trees from 20 to 27 feet in girth, and Major Madden records one tree which in 1830 measured 36½ feet in circumference fully 5 feet from the ground; and on a subsequent

journey he saw several on the northern declivity of the Booram and Roopin Passes not under 30 feet in girth, and from 150 to 200 feet high. The timber has a peculiar and strong odour, so that no insects will touch it; the grain is open, straight, not liable to warp, even if in thin boards and exposed to the weather, and may be considered the best wood of its class in the world; but, like all other woods of that class, if cut young it will soon decay when in contact with damp. Next to its timber, the most valuable product is its turpentine, which when rubbed on any other kind of timber renders it less liable to decay and the ravages of vermin.

The Deodar Cedar is called "Kelon," "Kolan," and "Kolain" in Gurhwal, all Sanscrit variations for Cedar and its resinous products. In Kunawur it is known as the "Kelmung" by the Arian population, and about Simla as that of "Keloo," "Kelou," and "Keoule," all vernacular terms for resin or its extracts. The Hindostanee names "Devadaru," "Deodara," and "Dewar" are all derived from "Deva," or "Derva" (deity), and "daru" (timber or tree), and rendered by Sanskrit writers as "Tree of God," "Spirit-bearer," "Divine tree," and "Lord of Cedars." In Kafiristan the tree is called "Nokhtur," on account of its prickly or pungent leaves; and the people of Nepaul, Cashmere, and Persia apply the same names and terms as those used by the hill people in India, and hold it in equal veneration. It has not yet been found in a wild state either in Eastern Nepaul or Sikkim, although these gigantic sons of snow fringe the bare rocks and fix their roots where there appears to be very little soil, on the lofty passes from Nepaul to Cashmere; and, according to Captain Pemberton (in his "Report on the Eastern Frontier"), the most southern point to which the Deodar has yet been traced is the summit of the lofty ranges immediately west of Munipoor, an interesting region, which, with the Singfo Mountains, south-east of Assam, carry the zone of perpetual snow farthest south in India. The Deodar also grows to extraordinary dimensions on all the higher mountains throughout the Western Himalayas, and occurs in vast forests in Kunawur, Kamaon, Kooloo, Mussoorie, and on the Chumbra range in Kangara, at elevations varying from 6,000 to 12,000 feet. At Rashulah, in Kooloo, a forest exists with trees from 18 to 24 feet in girth, at four feet from the ground; and according to Dr. Jameson, of two trees measured by him near Mulari, in Gurhwal, at an elevation of 11,000 feet, one girthed 26 feet at three feet from the ground, and the other 27 feet; but, as a general rule, the finest trees always are found growing on the north side of barren mountains, in thin, poor soil, formed from the decomposition of granite, gneiss, mica, or clay-slate. Captain Johnson, in his "Excursion to the Sources of the Jumna," states that the peaks on the northern side of the Boorung Pass were completely hidden by forests of gigantic Deodars, some of which measured 33 feet in circumference, and were from 60 to 70 feet

without a branch. Here, too, the character of the timber was different from that grown in southern aspects and rich soil, being more compact, harder, and of a deeper red, owing to its slow growth. The boat-builders along the Jhelum River distinguish its timber under the appellation of "Peliptur," and consider it the most valuable of all for its durability, both for naval and architectural purposes, the wood being compact, rather close-grained, long-fibred, highly resinous, deliciously perfumed, and lasting for a great number of years, even though much exposed to the elements, being but little affected by water, as boats built of its timber will last for twenty or thirty years, while those built of the "Cheer" (*Pinus longifolia*) only last six or seven (G. Gordon, "The Pinetum," 1875).

The excellence of Deodar timber is proved beyond all doubt; but the inaccessible situation of the forests and the cost of transport are at present insuperable obstacles to its general use in Britain. Whether the trees growing in this country will yield timber as good as that afforded by native trees, can only be determined by time, and as yet no trees of sufficient age and size exist in England to furnish any criterion of the quality the timber may prove to possess in its maturity. It must be remembered also that the Deodars in Great Britain are growing under climatal conditions very different from what they are on the Himalayas, where "for nearly half the year they are enveloped in snow, and where from the middle of March to the middle of June there is considerable dryness in most of the situations; from the middle of June to the middle of September there is a cloudy atmosphere, almost continual rain, and great moisture of the climate; in autumn there is fine clear weather" (Report of Dr. Royle to Her Majesty's Commissioners of Works).

The Deodar Cedar may be justly considered as one of the most graceful and lovely trees that adorn the pleasure-ground or forest, producing long, spreading, pendulous branches that are amply covered with branchlets which, when young, have a lightish grey bark. The leaves vary from an inch to nearly two inches in length, of a light glaucous colour, somewhat three-sided, acute at apex, quite linear throughout, growing in bundles on the old wood, but solitary on the young shoots. Male catkins cylindrical, from an inch to an inch and a half in length; somewhat club-shaped, with yellowish-coloured anthers tinged with red. Cones from 4 to 5 inches long, and from 8 to 9 inches in circumference, on short footstalks, quite erect, generally in pairs. Scales broad, membranous. The wood of the Deodar Cedar is considered to be almost imperishable. It has a strong smell of turpentine, and from the fineness of its grain is susceptible of a very high polish. This species of Cedar is supposed by some to be the one used in the construction of Solomon's Temple, but its never having been discovered on or near Mount Lebanon is a strong argument against this opinion. It is, however,

regarded by the Hindoos as a sacred tree, and designated by them "Devadera," or Tree of God. It is also inferred that this is the Algum-tree brought from Ophir by Solomon, which is represented to possess more valuable properties than the one that came from Lebanon. Mr. Lambert appears to have received from Dr. Wallich a section of a trunk of the *C. Deodara* measuring nearly 4 feet in diameter; he also quotes the following passage from Mr. Moorcroft's Journal relative to its durability: "A few years ago a building, erected by the order of the Emperor Akbar, was taken down, and its timbers (of Deodar) were found in a state so little impaired as to render them fit to be employed in a house built for my friend Rajah Shah. Supposing that the former edifice was constructed at the same time as the fort of Najurunger, A.H. 1006, or A.D. 1597, its age is two hundred and twenty-five years. Zenool Abudeen began to reign over Kashmeer A.H. 820, or A.D. 1417, and died A.H. 878, or A.D. 1473. His mother was interred in a domed building of excellent brick and mortar work, reported to have been erected in the time of the Hindoo sovereigns. Its solid walls, from 7 to 8 feet thick, differ much in character from the facing and rubble work in the reigns of the Mogul Emperors of Hindostan. In this building pieces of Deodar were inserted in the walls—by way, apparently, of strengthening the bond—and their ends, or sides, were left on the same plane with the brickwork. The window frames were of the same material, with the difference, however, of the former being squared, and deprived of the sapwood left, and the surface was only slightly smoothed, and partly retained in its original form. In the latter instance the crust of the wood was generally somewhat crumbly, and had been pierced by the worm about a quarter of an inch in depth; whilst that of the squared wood, exposed much more to the influence of the weather, was neither crumbly nor worm-eaten, but was jagged, from the softest part of the wood, between the plates or ribs, having often been washed by the rain, though its structure had not been attacked by the worm."

The introduction of the Deodar marks an epoch in the annals of British arboriculture. Its graceful and beautiful form in its young state, and its grand and imposing aspect in its maturity, place it in the highest rank as an ornamental tree, its value as such being greatly enhanced by the readiness with which it accommodates itself to almost all situations. No position and no variety of soil appears to come amiss to it; on lime or sandstone, rock or clay, it grows with equal facility (Earl Ducie in Trans. Roy. Scot. Arb. Soc. 1874).

Cedrus Deodara has only once (1878), to my knowledge, produced cones in Denmark. It was at Valloe, in Zealand. Trees about forty years old, and 30 feet high, or perhaps more, are met with.

In Professor F. C. Schübeler's "Viridarium Norvegicum" (1886) the following account is given at p. 443: "In Stavanger, on the S.W. coast of Norway, (68° 58' N. 3° 24' E.), there is to be found an example

of this species, which has the following history. In Carlisle, in the county of Cumberland, in the spring of 1855, a cutting was planted in a flower-pot. The owner afterwards moved to Stavanger, taking the plant with him, and planting it out in the garden in the spring of 1857. It was then only 12 inches high. When in 1863 he left Stavanger the tree was 5 to 6 feet high. It has never been protected in the winter time. In August 1877, when the tree was found by the forester-master Gloersen, it had the following dimensions: Height, 14 feet; at a height of $1\frac{1}{2}$ feet the stem had a circumference of 21 inches, and at a height of 3 feet it had a circumference of 17 inches. The greatest diameter of the crown was 9 feet. This tree since then has been twice much damaged, but a measurement which was taken in October 1885 gave the following results: Height, 51 feet; the circumference of the stem a foot from the ground, $28\frac{1}{2}$ inches, and the diameter of the crown 11 feet 6 inches. The tree now looks quite fresh."

At Stockholm *Cedrus Deodara* survived the winters of 1872-76, but in the winter of 1876-77 the crown was much injured. In sheltered situations it has since that year done fairly well, although the tops have in many instances been killed.

C. D. crassifolia, hort. Carr. Man. des Pl. 345.

This variety differs from the preceding one in having much thicker and shorter leaves, and much shorter and more compact branches, which are less pendulous.

C. D. robusta, hort. (the robust Deodar). *C. D. gigantea*, Knight.

A robust-growing variety, with a very glaucous appearance, and much larger in all its parts.

C. D. viridis, hort. (the green-leaved Deodar). *C. D. tenuifolia*, Knight.

A very distinct variety, on account of its bright grass-green colour and slender habit. It is entirely free from any glaucous appearance, even when young.

C. Libani, Barrel. Icon. 499; Loud. Arbor. Brit. iv. 2402, f. 2267-82, and Encycl. of Trees, 1057, f. 1974; Pinet. Wob. 145; Spach, Hist. Vég. Phan. xi. 427; Link in Linnæa, xv. 538; Knight, Syn. Conif. 42; De Chambr. Tr. Prat. des Arbr. Résin. 308; Carr. Tr. Gén. des Conif. 283; Gord. Pinet. 43; Henk. and Hochst. Syn. 144; Beissn. Nadelh. 297. *Cedrus magna*, sp. *Cedrelate*, Plin. Hist. Nat. xiii. 11, and xxiv. 11. *Alta Cedrus*, Bel. Conif. 3. *Cedrus*, Bel. It. 162; Trew. in N. A. N. C. iii. app. 445, t. 13, f. 1-7. *Cedrus magna*, sp. *Libani conifera*, J. Bauh. Hist. i. 277. *Cedrus conifera, foliis Laricis*, C. Bauh. Pin. 490. *Larix orientalis, fructu rotundiore obtuso*, Tourn. Inst. 586. *Cedrus phoenicea*, Reneaulm. Specim. 27. *Pinus Cedrus*, L. Spec. Pl. 1420. *Larix Cedrus*, Mill. Dict. n. 3. *Larix patula*, Salisb. in Linn. Trans. viii.

314. *Abies Cedrus*, Poir. Dict. vi. 510. *Cedrus patula*, Koch, Dendr. 1873, ii. 268.

Habitat.—The mountains of Syria and Asia Minor, especially Lebanon, and that portion of the Tauric range which extends through Cilicia. "In Monte Tauro præsertim Cilicio sylvas vastas construens" (Prodr. xvi. 408). Also in the island of Cyprus on the mountain near Khrysakus. The discovery of the Cedar in Cyprus is quite recent. It appears to be confined to one spot, and to differ from the known form in having shorter leaves and smaller cones (see paper by Sir J. D. Hooker in the "Journal of the Linnean Society," xviii. 517). Also in some parts of Algeria, where it grows together with *Cedrus atlantica*.

In Bellon's treatise, "De Arboribus Coniferis," published in 1553, the author says he was told that the Cedar of Solomon is found on Mount Lebanon, and also on Amanus and Taurus, and on the mountains above Nicea, but nowhere in the Isle of Crete. He then mentions several kinds of Juniper, all of which he calls Cedars; and states it to be his opinion that the great Cedar of Mount Lebanon was not the wood used for building Solomon's Temple. On another page, after relating his visit to Mount Lebanon, he says, "Right true and excellent are the trees of Mount Lebanon." He afterwards describes their appearance and mode of growth, adding: "The Cedars that we saw on Amanus and Taurus were very similar to these. They grew in moist places, like those in which the Spruce Fir (*Picea Abies*, L.) delights; and they are also found in moist valleys."

The Cedar of Lebanon has been long celebrated for its majestic growth, and frequent allusions are made to it in Holy Writ. In Isaiah xli. 19, it is thus stated: "I will plant in the wilderness the cedar; I will set in the desert the fir tree, and the pine." In Ezekiel xvii. 22: "Thus saith the Lord God; I will also take of the highest branch of the high cedar, and will set it; I will crop off from the top of his young twigs a tender one, and will plant it upon an high mountain and eminent." Again it is mentioned in the First Book of Kings vii. 2, that Solomon built "the house of the forest of Lebanon" with the Cedar tree; not that the house was erected on Mount Lebanon, but in consequence of the vast number of Cedar trees employed in its construction, especially those that constituted its numerous columns, which were all of the Cedar tree, and gave rise to its being designated "the house of the forest of Lebanon." It is also stated in Ezekiel xxvii. 5, "They have made all thy ship boards of fir trees of Senir: they have taken cedars from Lebanon to make masts for thee." In reference to this passage may be here quoted the following extract from a note relative to it in the "Pictorial Bible": "It is by no means certain that the tree to which naturalists have given the name 'Cedar of Lebanon' is the same as the 'Arez of Lebanon,' so often mentioned in Scripture. As the word in the Armenian dialects is applied to

several trees of the Pine tribe, it may very possibly have been the same in the Hebrew. Under this view it might sometimes denote the 'Cedar of Lebanon,' and often other trees of a similar character ; and if so, those equally err who insist that this tree can only be intended, and those who contend for some other particular species, to the exclusion of all the rest. Meanwhile it may be observed that the so-called 'Cedar of Lebanon' can hardly be intended in this particular text, as, although the trunk of this tree is large, it is neither long nor straight, and therefore utterly unfit to be the mast of a ship ; to which may be added, the wood is soft and inferior to the worst sorts of deal." Mr. Lambert, in his description of this tree, also observes :—

"The diuturnity of the Cedar we frequently find alluded to. The wood of this famous tree has been supposed to preserve books much better than any other material ; hence the expression 'cedro dignus' was considered one of the highest compliments that could be bestowed on a literary performance. It is recorded that in the Temple of Apollo at Utica was found Cedar-wood nearly two thousand years old ; and at Saguntum in Spain, in an oratory consecrated to Diana two hundred years before the destruction of Troy, a beam was discovered which has since been removed to Zante ; but, in the relation of the properties assigned to this tree, Professor Martyn says there is much vulgar error and confusion, the Cedar of Lebanon being often confounded with trees which belong to different genera. At least the accounts given by the ancients of the long duration of their Cedar very ill accord with the species now under consideration, whose wood is no more than a very inferior kind of deal, with little or no smell, and of a soft texture, evidently of short duration" (Pinet. Woburn. 147).

"The Cedars are mostly confined to one spot at the head of the Kedisha Valley ; they have, however, been found by Ehrenberg in valleys to the northward of this. The Kedisha Valley, at 6,000 feet elevation, terminates in broad, shallow, flat-floored basins, and is two to three miles across ; it is in a straight line 15 miles from the sea, and about three or four from the summit of Lebanon, which is to the northward of it.

"The Cedars form one group, about 400 yards in diameter, with an outstanding tree or two not far from the rest, and appear as a black speck in the great area of the corry and its moraines, which contain no other arboreous vegetation, nor any shrubs but a few small Berberry and Rose bushes, that form no feature in the landscape.

"The number of trees is about four hundred, and they are disposed in nine groups ; they are of various sizes, from about 18 inches to upwards of 40 feet in girth ; but the most remarkable and significant fact connected with their size, and consequently with the age of the grove, is that there is no tree less than 18 inches in girth,

and that we found no young trees, bushes, nor even seedlings, of a second year's growth. We had no means of estimating accurately the ages of the youngest or oldest tree. It may be remarked, however, that the wood of the branch of an old tree, cut at the time, is 8 inches in diameter (exclusive of bark), presents an extremely firm, compact, and close-grained texture, and has no less than one hundred and forty rings, which are so close in some parts that they cannot be counted without a lens. Calculating only from the rings on this branch, the youngest trees in Lebanon would average a hundred years old; the oldest two thousand five hundred years old, both estimates, no doubt, widely far from the mark. Calculating from trunks of English rapidly-grown specimens, their ages might be estimated as low, respectively, as five and two hundred years; while from the rate of growth of the Chelsea Cedar, the youngest tree may be twenty-two, and the oldest six to eight hundred years old.

"The positions of the oldest trees afforded some interesting data relating to the ages of the different parts of the grove, and the direction in which it had lately spread. There were only fifteen trees above 15 feet in girth, and these all occurred in two of the nine clumps, which two contained one hundred and eighty trees. Only two others exceeded 12 feet in girth, and these were found in immediately adjoining clumps, one on one side and one on the other of the above-mentioned. There were five clumps, containing a hundred and sixty-six trees, none of which were above 12 feet in girth, and these were all to the westward of the others. On this side, therefore, the latest addition to the grove had taken place.

"The wood of the Cedar is of a reddish white, light and spongy, easily worked, but very apt to shrink and warp, and by no means durable. The horizontal section, as Loiseleur Deslongchamps justly observes, exhibits the annual layers very distinctly marked. Each year has apparently two; the one narrow, close-grained, hard, and of a reddish brown, and the other three or four times broader, loose, spongy, and whitish. In general, the section of the trunk of a Cedar bears a nearer resemblance to that of the Silver Fir than to that of any other of the *Abietinæ*. When the tree has grown on mountains the annual layers are much narrower, and the fibre much finer, than when it has grown in plains; so much so that a piece of Cedar-wood brought from Mount Lebanon by Dr. Pariset in 1829, and which he had made into a small piece of furniture, presented a surface compact, agreeably veined, and variously shaded, which, on the whole, may be considered handsome" (*Hist. du Cedre*, &c. p. 43).

The date of the introduction of the Cedar of Lebanon into England cannot be fixed with certainty; it is not mentioned in Evelyn's "*Silva*," written in 1664, but there is evidence to show that its introduction was effected very shortly afterwards (Veitch).

The economic value of the Cedar of Lebanon in modern times,

otherwise than for ornamental planting, is inconsiderable; the timber of trees felled in Britain is inferior; "the wood is light, soft, brittle, apt to warp, and by no means durable" (Loud. Arb. et Frut. p. 2417).

In the expedition to Mount Lebanon, undertaken by Sir J. D. Hooker, Captain Washington, R.N., and other gentlemen, in the autumn of 1860, "a section of the lower limb of one of the oldest (which lay dead on the ground) was procured, which gave a totally different idea of the hardness of Cedar-wood from what English specimens do" (*Gardeners' Chronicle*, 1862, p. 67).

Lamartine, who visited the Cedars of Lebanon in 1838, wrote of them: "These trees are the most celebrated natural wonders in the world."

The ancients thought they grew nowhere else than upon Mount Lebanon, above all other vegetation—thus being peculiarly set apart—a belief which powerfully affected their religious ideas and at once excited veneration.

The Arabs, of all sects, to this day attribute to these trees not only vegetative force which enables them to live for ever, but also a soul having the power to express consciousness and feeling similar to animals, and approaching the intelligence of man; in fact, in the Arab mind they are divine beings in the form of trees.

The Maronite Christians inhabiting Lebanon are scarcely less pronounced in their regard for this tree than the Moslem Arabs, for annually the patriarch of that sect, attended by scores of bishops, priests, monks, and five or six thousand of devotees, ascend to the Cedar grove and there celebrate in their shade the "Feast of the Transfiguration," and ecclesiastical censures are denounced against those who shall injure these consecrated trees in any manner.

In a delightful article published in the *Pacific Rural Press*, by Mrs. Jeannie C. Carr, of Pasadena, Cal., she states: "The oldest Cedar of Lebanon in Europe is growing in the Jardin des Plantes, in Paris, where it was planted by the elder De Candolle, who brought it from Palestine over a century ago.* It is related that the vessel in which he crossed the Mediterranean was unseaworthy, and during the prolonged voyage the sailors and passengers suffered greatly from the scarcity of water, but De Candolle resolutely denied himself and gave his scanty portion to the little tree, which, thus saved from perishing, has become the living monument of the great botanist."

The oldest Cedar of Lebanon in America is in Philadelphia, raised from seed planted by the veteran American botanist Bartram in his now famous garden (J. G. Lemmon).

* A specimen now growing at Bretby in Derbyshire was planted in year 1676. *Vide* page 489.—[Eds.]

32. PSEUDOLARIX.—*Abietis* sp. Lindl. in Penny Cycl. i. 34. Genus *Pseudolarix*, Gord. Pin. 292; Carr. Conif. ed. 2, 363; Masters, Contrib. to Hist. of certain Species of Conif. in Linn. Soc. Journ. xxii. 208; Henk. and Hochst. Nadelh. 139; Parl. in DC. Prodr. 412 (*Pini* sect.); C. Koch, Dendr. 265 (sub-genus); Eichl. in Engl. and Prantl, Natürl. Pflf. ii. s. 77; Beissn. Nadelh. 309; H. Mayr, Monographie der Abietineen des Japanischen Reiches, 1890.

Flowers monœcious.

Cones oblong, pendent, brittle, and, like the head of the common Artichoke, covered with divergent scales.

Scales very deciduous, extended at the points, heart-shaped at the base, and enclosing at the bottom two soft-coated seeds.

Seeds irregularly shaped, with a soft, thin, whitish, skin-like covering, more or less enclosed by the wing, but free, and full of turpentine.

Wings ovate-lanceolate on the outer side, but quite straight on the inner one, and entirely covering the inner face of the scale.

Leaves deciduous, soft, linear, flat, and collected in bundles on the adult plants, but scattered singly along the young shoots, and very long on the young plants.

Cotyledons from five to seven in number.

Name derived from *pseudo*, false, and *larix*, the Larch—the false or Chinese Larch.

A noble, hardy tree found by Mr. Fortune in the central and north-east provinces of China, and very distinct from the European Larches, in the cones having deciduous scales with divergent points (G. Gordon, "The Pinetum," 1875).

P. Fortunei, Gord. Pinet. 292. *Larix conifera*, &c., Kämpf. Amœn. Exot. 883. *L. Kämpferi*, Fortune. *Pinus Kämpferi*, Lamb. Pin. ed. 3, 7. *Abies Kämpferi*, Lindl. in Penny Cycl. i. 34.

Habitat.—The mountains of North-east China, in the province of Che-Kiang, at an elevation of about 1,000 metres.

Introduced into Europe in 1846 by Robert Fortune. Dr. H. Mayr says in his "Monographie der Abietineen des Japanischen Reiches," 1890, p. 64: "Kämpfer's Larch is without doubt our *leptolepis*; therefore it would be better to change the name *Larix Kämpferi*, and that derived therefrom, *Pseudolarix Kämpferi*, to another name, which would obviate all mistake." Further on, at page 99, he says: "To that mentioned by Kämpfer in 1712 (*Larix conifera*), Lambert has, in his 'Pinetum,' 1832, given the specific name *Kämpferi*. The description, the locality in which Kämpfer had collected it, the name he gave the plant (*Kara-matzu-mom*), leave no doubt that he meant *leptolepis*. Fortune has identified the Larch he discovered in 1845 with that of Kämpfer's, and also given it the specific name *Kämpferi*. But to prevent all errors, I would like to propose to call it '*Pseudolarix*'

Fortunei, Mayr.' Fortune's Pseudo-larch is neither to be found growing wild in Japan, nor is it at the present day cultivated there."

The *Pseudolarix* is only to be found as small plants in Denmark ; but I suppose the species will prove hardy. *P. Fortunei* is a highly ornamental tree, the foliage of which in spring is of the most delicate pea-green, and towards autumn assumes a bright or clear golden-yellow. Even when leafless, the beautiful yellowish-green or golden-brown of the young shoots is particularly effective, and as uncommon as it is beautiful. We have found the Golden Larch to be perfectly hardy, to succeed well, perhaps best, on a free, gravelly loam, and to bear stem and branch pruning with impunity. It is the only deciduous golden Conifer at present introduced, and is the largest in growth. For its ornamental qualities it is certainly well worthy of extended culture (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

33. LARIX.—Endl. Conif. 128. *Larix* sp. Tourn. Inst. 586. *Abietis* sp. Juss. Gen. Pl. 414 ; Rich. Conif. 147, t. 13. *Larix*, Link in Linnæa, xv. 533, and pl. auct. ; Spach, Hist. Vég. Phan. xi. 431 ; Carr. Conif. 351 ; C. Koch, Dendr. ii. 257 ; Gord. Pinet. 123 ; Henk. and Hochst. Nadelh. 128 ; Endl. Syn. Conif. 128 (*Pinus*, sect. *Larix*) ; Parl. in DC. Prodr. xvi. 2, 409 (*Pinus*, sect. *Larix*) ; Eichl. in Engl. and Prantl Natürl. Pflf. ii. 75 ; Willk. Forstl. Fl. 136 ; Beissn. Nadelh. 314 ; H. Mayr, Monographie der Abietineen des Japanischen Reiches, 1890, 62.

Flowers monœcious ; the male catkins small, without footstalks, and egg-shaped ; the female ones erect, solitary, ovate, and much larger than the males.

Cones small, ovate-obtuse, or somewhat cylindrical, and consisting of but few scales.

Scales persistent, leathery, thin towards the margins, and a little reflexed or undulated.

Bracts either longer or shorter than the scales, unevenly notched on the edges, ovate-pointed, or lanceolate.

Seeds very small, with a leathery covering and membranaceous wings.

Cotyledons from five to seven in number.

Leaves deciduous, linear, obtuse, soft, without footstalks, and either produced in bundles or singly.

The name Larch, according to some authors, is derived from the Celtic word *lar* (fat), on account of the tree producing an abundance of resinous matter, which flows externally down its stem, and which Ovid describes in the following lines :—

"The new-made trees in tears of amber run,
Which harden into value by the sun."

But, according to other writers, the name is derived from the Welsh

lar (wide-spreading), on account of its horizontally extended branches. Its Spanish name, "Alerce," and its Italian one, "L'Arice," are derived from the Arabic "Al-araz," a kind of Cedar, or coniferous tree.

All deciduous trees, found in the colder parts of Europe, Asia, and America.

L. americana, Michx. Fl. Bor. Amer. ii. 203 ; Michx. fl. Arbr. Forest. iii. 38, t. 4 ; Loud. Arbor. Brit. iv. 2399, and Encycl. of Trees, 1057, f. 1973 ; Henk. and Hochst. Syn. 137 ; Beissn. Nadelh. 329. *Pinus Larix rubra*, Marsh. Arb. 103. *P. microcarpa*, Lamb. Pinet. ed. 1, t. 37. *P. intermedia*, Du Roi, Harbk. Wild. Baumz. ii. 115. *P. pendula*, Parl. in DC. Prodr. xvi. 2, 409. *Larix microcarpa*, Pinet. Woburn. 139, t. 47. *L. tenuifolia*, Salisb. in Linn. Trans. viii. 313. *L. intermedia*, Link in Linnæa, xv. 535. *L. laricina*, Koch, Dendr. ii. 263. *L. Fraseri*, Curt. ex Gord. Pinet. 129. *L. americana rubra*, Loud. ex Knight, Syn. Conif. 40. *Abies microcarpa*, Lindl. and Gord. Journ. Hort. Soc. v. 213.

Habitat.—Northern Newfoundland and Labrador to the eastern shores of Hudson Bay, Cape Churchill, and north-west to the northern shores of the Great Bear Lake and the valley of the Mackenzie River within the Arctic Circle ; south through the Northern States to Northern Pennsylvania, Northern Indiana and Illinois, and Central Minnesota.

Introduced in 1739 by Peter Collinson.

A tree 80–100 feet in height, with a trunk 2–3 feet in diameter ; moist uplands and intervening lands, or south of the boundary of the United States in cold, wet swamps, often covering extensive areas ; here much smaller and less valuable.

Wood heavy, hard, very strong, rather coarse-grained, compact, durable in contact with the soil ; bands of small summer cells broad, very resinous, dark-coloured, conspicuous, resin passages few, obscure ; medullary rays numerous, hardly distinguishable ; colour light brown, the sapwood nearly white ; specific gravity, 0·6236 ; ash, 0·33 ; preferred and largely used for the upper knees of vessels, for ship timbers, fence posts, telegraph poles, railway ties, &c. (C. S. Sargent).

The inner bark of the closely allied European Larch is recommended in the treatment of chronic catarrhal affections of the pulmonary and urinary passages ; probably that of the American species would be equally efficacious (C. S. Sargent).

Larix americana—or, as it is often called, *microcarpa*—is to be found in Danish gardens about 40 feet high.

L. dahurica, Turcz. in Bull. Soc. Nat. Mosq. 1838, 101 ; Trautv. Imag. Plant. 48, t. 32 ; Knight, Syn. Conif. 40 ; Carr. Tr. Gén. Conif. 270 ; Gord. Pinet. 123 (excl. syn.) ; Henk. and Hochst. Syn. der Nadelh. 138 ; Beissn. Nadelh. 328. *L. kamtschatica*, Carr. Traité Gén. Conif. ed. 1, 279. *Pinus Larix americana*, Pall. Flor. Ross. i. 2, t. 1, fig. e. *P. dahurica*, Fisch. in Endl. Conif. 128.

P. kamtschatica, Endl. Conif. 135. *Abies Gmelini*, Rupr. Bietr. Pf. Russ. Reich. ii. 56. *L. amurensis*, hort.

Habitat.—Near the Amur River, Amurland, Saghalien, Dahuria, and eastern parts of Siberia.

Hardy.

L. europæa, De Cand. Fl. Franc. iii. 277; Loud. Arbor. Brit. iv. 2350, f. 2258-62, and Encycl. of Trees, 1053, f. 1972; Pinet. Wob. 133; Link in Linnæa, xv. 534; Desf. Hist. Arbr. ii. 567; De Chambr. Tr. Prat. Arbr. Résin. 277, pl. 3, f. 16, 17; Schouw in Ann. Sc. Nat. ser. 3, ii. 241; Knight, Syn. Conif. 40; Carr. Traité Gén. des Conif. 276; Gord. Pinetum. 124; Henk. and Hochst. Syn. dex. Nadelh. 130; Beissn. Nadelh. 321. *Pinus Larix*, L. Spec. Pl. 1420. *P. L. a communis*, Endl. Conif. 134. *L. decidua*, Mill. Dict. n. 1. *L. vulgaris*, Fisch. in Spach, Hist. des Pl. Phan. xi. 432. *L. excelsa*, Link in Abh. Berl. Akad. d. Wissensch. 1827, p. 182. *L. pyramidalis*, Salisb. in Linn. Trans. viii. 313. *L. decidua a communis*, Hook. and Hochst. Syn. p. 130. *L. europæa communis*, Laws. Man. 386. *Abies Larix*, Lam. Illustr. t. 785.

Habitat.—On the whole region of the Alps and in Central Europe, chiefly at altitudes of from 3,000 to 5,000 feet, forming dense forests, often intermixed with the Spruce and Silver Firs, and sometimes with the Cembra Pine; also on the Carpathian and Sudetian Mountains; also in Siberia, from the Ural Mountains to Kamtschatka.

Introduced into England prior to 1629, in which year it is mentioned by Parkinson in his "Paradisus."

Larix europæa, the common Larch, is considered by many to be by far the most valuable of all our coniferous trees. The wood is applicable to almost any purpose, and weighs when green 68 lbs. 13 oz., and when dry 36 lbs. 6 oz. per cubic foot. It makes a first-class charcoal. The sap furnishes the Venetian turpentine of commerce, the branches exude the manna of Briançon, and the bark supplies excellent tannin. The tree being thus useful in all its parts, we may well ask, Where is its equal or substitute to be found?

The wood of the European Larch, according to Kasthöffer, lasts four times longer than that of any other species belonging to the tribe Abietinæ. The wood of trees produced in a good soil is of a yellowish white, but that of trees grown in a cold and elevated situation is reddish or brown, and very hard. In a suitable situation the timber is said to come to perfection in forty years, while that of the Pinaster (*Pinus Pinaster*) requires sixty years, and that of the Scotch Pine (*P. silvestris*) eighty years (Trans. Soc. Art. xxix. 25).

The wood of *Larix europæa* is used in Switzerland for covering the roofs of houses, being cut into shingles of about a foot square and half an inch in thickness, which are nailed to the rafters. At first the roofs appear white, but in the course of two or three years become perfectly black, and the joints are stopped by the resin which the sun extracts

from the pores of the wood, and which renders the roof impenetrable to rain. The tree is sufficiently frequent in that country to render the covering a cheap one.

It is from *Larix europæa* that the true Venetian turpentine is extracted. This substance has been procured in the greatest abundance near Lyons, in France, and in the Valley of St. Martin, near Lucerne, in Switzerland. But what is very remarkable, the inner part of the wood of this tree yields a pure gum, scarcely inferior in its qualities to the Arabian gum. In the Russian empire this has been received into the shops, and sold under the name of Orenburg gum, an appellation extremely improper, as Pallas justly observes, Orenburg being very distant from the Uralensian forests, where the gum is collected from *Larix sibirica*. Possibly this product is obtained from *Larix europæa* as well.

Larix europæa is to be found in Danish plantations at an age of more than a hundred years, and with a height exceeding 100 feet.

A tree of this species planted on the Danish island of Moen a hundred years ago now measures over 100 feet in height, with a girth of more than 8 feet; while another planted in 1882 has already attained a height of 33 feet and a girth of 1 foot 8 inches.

In Sweden the Larch grows well in Aangermanland and the southern parts of Norbotten.

In Finland it has been planted at Uleaborg (65°). At Svartæ (60° 8') a Larch fourteen years old was measured, and found to be 16 feet in height. At the Forest Academy at Evois (61° 15') a tree eleven years old measured 15 feet in height and 6 inches in diameter ("Catalogue Spécial d'Objets envoyés à l'Exposition de Moscou en 1882," Helsingfors, 1882, p. 14).

Larix europæa does not belong to the Scandinavian flora, as stated in some works on Conifers. A wrong translation of "in montibus Sudetris" may have caused this error.

In Norway it was first planted at the close of the eighteenth and the beginning of the nineteenth centuries. Prof. Schübeler, in his "Viridarium," says that the most northern point where he has seen the Larch planted is at Tramsø (69° 40'), but there it was only a shrub, as it is rather windy at that place, and the ground sandy and stony. At Røros (Röros), near the Swedish frontier, where sometimes there is even more than 50° C. of frost registered, Larch trees are to be found as high as 30 feet.

It is strange that the name *Larix* leads to so many mistakes; for instance, in a German botanical and physiological work recently published it is said that *Pinus Laricio* is the common Larch!

L. e. pendula, Laws. Man. 386. *Pinus laricina*, Du Roi, Obs. Bot. 49. *P. Larix nigra*, Marsh. Arbr. 103. *P. Larix repens*, Endl. Conif. 134. *P. pendula*, Sol. in Ait. Hort. Kew. ed. 1, iii. s. 369. *Larix pendula*, Salisb. in Linn. Trans. viii. 313. *L. intermedia*, Lodd. Cat. 1836, 50.

L. decidua pendula, Regel in Gartenfl. 1871, s. 102. *L. decidua americana*, Henk. and Hochst. Conif. s. 133. *L. americana pendula*, Loud. Encycl. of Trees, 1057.

By some authors this variety is supposed to be of American origin. It is hardy in Denmark.

L. Griffithi, Hook. fil. and Thompson. *Pinus Griffithi*, Parl. in DC. Prodr. xvi. 2, 411. *Abies Griffithiana*, Lindl. and Gord. Journ. Hort. Soc. v. 214. *Larix Griffithiana*, Gord. Pin. 126.

Habitat.—The temperate forests in the Eastern Himalayas, and in Eastern Nepaul, Sikkim, and Bhotan, at from 8,000 to 12,000 feet elevation.

Introduced in 1850.

A small tree, not exceeding 40 feet in height, with precisely the habit of *L. europæa* var. *pendula*, which it so closely resembles as to have deceived myself and others. It differs from that plant in the very large cones with very long points to the exerted bracts. It is called "Sah" or "Saar" by the Lepchas of Sikkim, and "Boarge sella" by the Nepalese, who informed me that it was found as far west as the heads of the Cosi River in Eastern Nepaul. It occurs only towards the heads of the valleys near the snows, many miles from the plains of India, at elevations of 10,000 to 12,000 feet, and where I first saw it clothing old moraines; and though subsequently met with on grassy or bushy slopes, it was only where there was much rock and free drainage. The wood is regarded as the most durable of all the Sikkim Conifers, and is easily split into planks; but all of those that I have met with were small, soft, and white; I never saw any hard, close-grained red wood, like that of the Larch in Switzerland, which may be accounted for by the extreme wetness of the Sikkim climate.

The cultivation of the Himalayan Larch in Europe has hitherto proved a total failure, at least as far as I have ascertained. I sent quantities of the seed to Kew in 1848, which germinated freely, and hundreds of plants were raised and widely distributed; but in every case these succumbed, in a few years, to virulent attacks of *Coccus Laricis*. Repeated importations of the seed into Kew and elsewhere have met no better fate. I have often been shown *L. europæa* for *L. Griffithi*, sometimes with the most positive assurance that the tree was received as such from Kew; but in no instance have these borne the unmistakable cone of the Himalayan Larch (J. D. Hooker, *Gard. Chron.* 1886, p. 718).

This species is perhaps hardy in Denmark.

L. kurilensis, new spec., H. Mayr, Monogr. der Abietineen des Jap. Reiches, 1890, 66, 5, f. 15.

Habitat.—It grows in the Kuriles, but not on Kunashiri. It only commences on Shikotan, where it forms a small tree; but on Iturupp (Japanese Etorofu) it grows into a tree of the height and habit

of the Central Japanese Larch (*Larix leptolepis*). Eight degrees farther north than Iturupp, in Kamtschatka, in the vicinity of Peter-Paul's Harbour, Ruprecht found a Larch, which he described as *Abies kamtschatica*. It may be the same. *L. kurilensis* is not to be found on Eso. It grows in the Kuriles intermixed with *Picea ajanensis* and *Abies sachalinensis*.

L. leptolepis, Murr. Pines and Firs of Japan, 89; Gord. Pinet. 128; H. Mayr, Monogr. Abiet. Jap. Reich. 1890, 63. *L. japonica*, Carrière, Conif. ed. 2, 353. *L. Sieboldi*, Zucc. *Abies leptolepis*, Sieb. and Zucc. Fl. Jap. 12, t. 103. *Pinus leptolepis*, Endl. Conif. 130. *P. Larix*, Thunb. Fl. Jap. 275.

Habitat.—Japan. Dr. Mayr says that *Larix leptolepis* grows into a tree of great size. In the cooler forests some very strong examples are intermixed, but the greatest number are to be found in the temperate regions on volcanic ground; a few go near to the alpine region. This Japanese Larch only occupies a somewhat small area; it extends no further south than Fuji-san, at $35\frac{1}{2}^{\circ}$ N., its most northern point being 38° N.; beyond this it is not found, neither is it on the Island of Eso. It is of no greater value as a forest tree than the European Larch, but in its youth it is certainly more beautiful in appearance.

Introduced in 1861 by Mr. J. G. Veitch.

Hardy.

L. occidentalis, Nutt. N. Amer. Sylv. iii. v. 143, t. 120. *Pinus Nuttalli*, Parl. in DC. Prodr. xvi. 2, 412. *Larix americana brevifolia*, Carr. Conif. ed. 2, 357.

Habitat.—British Columbia, Selkirk and Gold ranges, south of latitude 53° N., extending west to the head of Okanagan Lake (G. M. Dawson), south along the eastern slopes of the Cascade Mountains to the Columbia River, through the mountain ranges of Northern Washington Territory to the western slopes of the Rocky Mountains of Montana, and on the Blue Mountains of Washington Territory and Oregon.

A noble tree of great economic value, 100 to 150 feet in height, with a trunk 3 to 5 feet in diameter; moist mountain slopes and ledges between 2,500 and 5,000 feet elevation; scattered among other trees, and never exclusively forming forests, the thick bark long resisting the action of forest fires; very common, and perhaps reaching its greatest development, in the region north of the Big Blackfoot River and in the Flathead River, Montana; here the largest and most valuable timber tree.

Wood heavy, exceedingly hard and strong, rather coarse-grained, compact, satiny, susceptible of a fine polish, very durable in contact with the soil; bands of small summer cells broad, occupying fully half the width of annual growth, very resinous, dark-coloured, conspicuous; resin passages few, obscure; medullary rays numerous, thin; colour light bright red, the thin sapwood nearly white; specific gravity, 0.7407;

ash, 0.09 ; occasionally manufactured into lumber, but principally used for fuel, posts, railway ties, &c. (C. S. Sargent).

Citizens of the Eastern States who visit the North-west are surprised to find Tamarack trees occupying dry, exposed ridges on mountain sides, instead of in the low swamps that the eastern species affect, and still more to find the timber of the western species so valuable and popular for all purposes of building, such as the manufacture of bridges, railroad ties, fence posts, and all other uses where durability is desired.

A peculiarity of the tree is the thick, coarse bark, that has the protective merit of long resisting the action of forest fires.

Recently surveyors for the California and Oregon Railway discovered a grove of Tamarack trees on the upper waters of Luckiamute River, one of the small western branches of the Willamette River, and near the summit of the low range of coast mountains south-west of Dallas, Oregon.

Little could be learned of the trees except that they were tall, straight, and seemed suitable for purposes of bridge-building, railroad ties, and perhaps for general lumber. Examination is desirable to determine whether or not this is a distinct species, but the probabilities are that it is an outlying form of *Larix occidentalis*, the Great Western Larch (J. G. Lemmon, "California State Board of Forestry," 1889-90).

A young tree planted out for trial in Denmark some years ago has made splendid growth.

L. sibirica, Ledeb. Fl. Alt. iv. 204. *L. europæa* β *sibirica*, Loud. Encycl. of Trees, 1054. *L. decidua* β *rossica*, Henk. and Hochst. Conif. s. 132, partly. *L. decidua* β *sibirica*, Rgl. Gartenflora, 1871, s. 101. *Abies Ledebouri*, Rupr. in Beitr. z. Flor. Russl. ii. 56. *Pinus Ledebouri*, Endl. Conif. 131. *P. intermedia*, Fisch. in Schtshagl. Anz. Entedeck. viii. 3 (not Dur.).

This species, Professor Pallas says, is found in cold mountainous places, from the Ural Mountains northwards, through Siberia and Kamtschatka, to the Pacific Ocean. It delights in a middle station on the sides of mountains, where it is sheltered from the north and exposed to the east wind, growing in a gravelly or rocky soil. In valleys and marshes, or on the very tops of mountains, it never occurs. It extends as far north as lat. 68°, where it forms a trailing shrub ; but in the south of Siberia and Russia it grows to the same height and bulk as the European Larch. In the north it has more the habit of the American Larch ; but it differs, he adds, from that species very essentially (Fl. Ross. pt. 1, p. 2).

I have seen fine examples of this tree in Russia and in Finland, and I am convinced of its hardiness. I also think its growth is even better, and more straight and erect, than is the case with the European species.

34. PICEA, Link.—Endl. Conif. 112. *Picea*, sec. 1A, *genuinæ*, Link in Linnæus, xv. 516. *Picea*, Carr. Conif. 236, 317. *Abies*, Don in Loud. Arbor. Brit. iv. 2293; Parl. in DC. Prodr. xvi. 2, 413 (*Pini* sec.); Engelm. Bot. Calif. ii. 121; Nees. Gen. Fl. Germ. Monoch. n. 7; Reichb. Ic. Fl. Germ. t. 532; L. C. Rich. Conif. t. 15; Lamb. Pin. t. 25–29, and min. ed. t. 35–39; Forb. Pin. Wob. t. 32–36; Zaub. and Spach, Pl. Or. iii. t. 14; Ledeb. Ic. Fl. Ross. t. 499; Wall. Pl. As. Rar. t. 246; Sieb. and Zucc. Fl. Jap. t. 3; Nutt. N. Am. Sylv. t. 146–148; Newberry, Bot. Williams Exped. t. 9; C. Koch, Dendr. ii. 232 (*Abies*, Don); Panic, Eine neue Conif. in d. Östl. Alpen, Belgrad, 1876; Eichler in Engl. and Prantl, Natürl. Pfl. ii. s. 77; Willk. Forstl. Flor. s. 65; Beissn. Nadelh. 331; H. Mayr, Monogr. der Abiet. des Jap. Reich. 1890, 43.

Flowers monoecious; the male catkins axillary or terminal, the female ones terminal and solitary.

Cones pendent, solitary, terminal, and remaining on for a long time.

Scales persistent, leathery, thin, broadly rounded, and sometimes undulated on the edges.

Seeds oblong, pointed with a short, stiff, deciduous wing, and bony shell.

Bracts small and hidden by the scales.

Cotyledons from seven to nine in number.

Leaves solitary, four-sided, acute-pointed, and scattered all round the shoots.

All evergreen trees, found in the colder parts of Europe, Asia, and America. The ancients called the Spruce Fir "*Picea*," and the Silver Fir "*Abies*," but by some inadvertence Linnæus reversed the names, and thus created great confusion in their nomenclature. The English and some of the American writers still follow Linnæus, and apply the name *Abies* to the Spruces, and *Picea* to the Silver Firs (so also have Don, Loudon, Gordon, Emerson, &c.), while nearly all the French, German, and other Continental authors follow Bauhin and Du Roi, and reverse the terms, applying *Picea* to the Spruces, and *Abies* to the Silver Firs. Pliny called *Picea excelsa* "*Picea*," and distinguished it from the Silver Fir, as the "*tonsili facilitate*," on account of its fitness to be shorn, or clipped into hedges; and Professor Link observes that the true Spruces approach nearest to that of *Pinus*, and that upon close inspection still more so than at a first glance. He says: "For instance, if the leaves that stand singly are examined minutely, it will be seen that several of them have their surface grown together, and consequently they are in tufts, like the leaves of the true Pines; and as a proof that this is the case, it will be found that there is no upper surface on the leaves of the Spruces, but that the leaves present only the under surface on both sides, as will be seen on comparing them with the leaves of the true Pines. The seam where the leaves

are joined may be distinctly seen, for it forms a line in relief on both sides of the leaves of the common Spruce, which is never the case when such line is formed by the midrib, because it is then either on the upper or under side. Some Spruces have two leaves grown together, others four; the sheaths at the base of the leaves are not observable, but appear to have grown together in the footstalk." In addition, Professor Link points out the following differences between the leaves of the true Spruces (*Picea*) and Silver Firs (*Abies*). The leaves of the Silver Firs, he says, "do not grow together, but are single, and have the usual form of single leaves, the midrib being only visible on the under side; the upper one, having a furrow down the centre of the leaf, is flat, divided at the point, and dark green, with two white stripes on the under side, one on each side of the midrib, and arranged in two or more rows along the shoots in a more or less lateral position."

P. acicularis, Maxim. *P. japonica*, Regel.

Habitat.—In the Japanese mountains. Some authors believe it to be a form of *P. Alcockiana* (*P. bicolor*). Regel regards it as an alpine form.

Hardy.

P. ajanensis, Fischer, ex Lindl. and Gord. Journ. Hort. Soc. v. 212; Carr. Tr. Gén. Conif. 259, 12; Flor. Ochot. 87; Masters in Linn. Journ. xviii. 508; Hook. Bot. Mag. t. 6743; Yataba, Catal. of Pl. Bot. Gard. 208; Engl. and Prantl, Natürl. Pfl. ii. 1, s. 58; Mayr, Monogr. Abiet. Jap. 53, 4, f. 10. *Abies ajanensis*, Lindl. and Gord. Journ. Hort. Soc. v. 212; Maxim. Prim. Fl. Amur. 261, 686; Veitch, Man. Conif. 66. *A. jezoënsis*, Sieb. and Zucc. Fl. Jap. 110; Lindl. and Gord. in Journ. Hort. Soc. l.c.; Knight, Syn. Conif. 37; Carr. Tr. Gén. Conif. ed. 1, 255; Gord. Pinet. ed. 1, 17; Murr. Pines and Firs of Japan, 72; Henk. and Hochst. Syn. der Nadelh. 137, 199; Miquel, Prolus. Fl. Jap. 330; Hoopes, Evergreens, 180, 12; Sieb. and Zucc. Rein. Jap. ii. 280, s. 25. *Picea jezoënsis*, Carr. Tr. Gén. Conif. ed. 1, 255, 9. *Abies microsperma*, Lindl. Gard. Chron. Jan. 12, 1861, 22; Henk. and Hochst. 186. *A. microcarpa*, Lindl. Miquel, Prolus. Fl. Jap. 389. *Abies ajanensis* var. *microsperma*, Veitch, Man. Conif. 66. *Picea ajanensis* var. *japonica*, Maxim. ii. Reise. *P. japonica*, Maxim. Index. Seminum Hort. Petropolitan. 1865, 33; Parl. in DC. Prodr. xvi. 2, 431. *Abies Menziesii*, Loud. Franch. and Savat. Enum. 467; Cat. of Pl. Koishikawa Bot. Gard. 92. *A. sitchensis*, Lamb. Koch, Dendr. ii. 247, 28. *A. Schrenkiana*, Lindl. and Gord. Pinet. ii. 18. *Pinus Menziesii*, Dougl. Parl. in DC. Prodr. 418, 87. *Picea obovata* var. *Schrenkiana*, or *ajanensis*, Engl. and Prantl, Natürl. Pfl. 79.

Habitat.—It is found in Eastern Siberia. Dr. Mayr says that it is at home in Japan on all the mountains of Eso. It only reaches the coast in the west of the island, and on swampy ground behind the sand-dunes, where it extends almost to the sea, close to which grows a

small vegetation of Roses (*Rosa rugosa*) and some poorly developed Oaks (*Quercus dentata*). The greatest forests of this Fir are found in the western and central mountains between Kitomi Kushiro and Nemora, where it is mixed with *P. Glehnii*; from the north-east corner of Eso they go over to the Kuriles. It is also at home on Sachalin, and on the neighbouring continent. Dr. Mayr also says that this Fir, as a profitable forest tree, has no advantage over European Firs; but seen away from the North American blue-white species and varieties, it is to be considered one of the most beautiful of the blue-white varieties.

Introduced in 1861 by John Gould Veitch.

Hardy.

P. alba, Link in Linnæa, xv. 519. *Abies canadensis*, Mill. Dict. n. 1 (not Michaux). *Pinus canadensis*, Du Roi, Observ. Bot. 38. *P. laza*, Ehrh. Beitr. iii. 24. *P. glauca*, Monch. Weissenb. 73. *P. tetragona*, Monch. Meth. 364. *Abies alba*, Michx. Fl. Bor. Amer. ii. 207 (not Mill.). *Pinus alba*, Ait. Hort. Kew. ed 1, iii. 371. *P. americana alba*, hort. *Abies americana alba*, hort. *A. curvifolia*, hort.

Habitat.—Newfoundland, northern shore of Labrador to Ungava Bay, Cape Churchill, and north-westward to the mouth of the Mackenzie River and the valley of the Yukon River, Alaska; south to the coast of Maine, North-eastern Vermont (West Burke and Elmwood, Pringle), Northern Michigan, Minnesota to Moose Lake and the Wabigoon Earth Indian Reservation, the Black Hills of Dakota (R. Douglas), along the Rocky Mountains of Northern Montana to the valley of the Blackfoot River (Canby and Sargent), Sitka, and British Columbia.

A tree 50-170 feet in height, with a trunk 2-3 feet in diameter; low, rather wet soil, borders of ponds and swamps; most common north of the boundary of the United States, and reaching its greatest development along the streams and lakes of the Flathead region of Northern Montana, at an elevation of 2,500 to 3,500 feet; the most important timber tree of the American sub-arctic forests north of the sixtieth degree of latitude; here more generally multiplied and of larger size than the allied *P. nigra*, with which it is associated; its distribution southward in British Columbia not yet satisfactorily determined.

Wood light, soft, not strong, close, straight-grained, compact, satiny; bands of small summer cells thin, not conspicuous; resin passages few, minute; medullary rays numerous, prominent; colour light yellow, the sapwood hardly distinguishable; specific gravity, 0.4051; ash, 0.32; largely manufactured into lumber, although not distinguished in commerce from that of the Black Spruce (*P. nigra*) (C. S. Sargent, "Forest Trees of North America").

A tree of this species planted in Danish ground in 1864 is now 38 feet high, with a girth of 2 feet 3 inches; and one planted at

Frijsenborg sixty years ago now measures more than 60 feet in height.

P. a. echinoformis, Carr. Conif. 321. *Abies alba echinoformis*, hort.

P. Alcockiana, Carr. Conif. ed. 2, 343. *Abies Alcoquiana*, J. G. Veitch and Lindl. in Gard. Chron. 1861, 23, and 1862, 308. *Abies bicolor*, Maxim. Mém. Biolog. vi. 24 (1886), in Bull. Acad. Imp. Sc. St. Petersb. x. 488. *Pinus Alcoquiana*, Parl. in DC. Prodr. xvi. 2, 417 (1868). *Abies acicularis*, hort. (not Maxim.). *A. excelsa* var. *acicularis*, hort.

Dr. Mayr, who has lived in Japan during the last few years, proposes to refer *P. Alcoquiana* to *P. bicolor*. For the present I prefer to retain the name *P. Alcockiana* until some of our plants can be determined.

P. bicolor, H. Mayr. *Abies Alcockiana*, Lindl. and Veitch, Gard. Chron.; Murray, Pines and Firs of Japan, 66; Henk. and Hochst. Syn. 185; Miquel, Prolus. Fl. Jap. 389; Koch, Dendr. ii. 245, 27; Yoyo mokusai, 24; Hoopes, Evergreens, 176, 9; Le Japon à l'Exposition Univ. 110, 20; Gord. Pinet. 4; Veitch, Man. Conif. 67; Rein. Japan. ii. 280, 25. *Pinus Alcockiana*, Parl. in DC. Prodr. xvi. 2, 417. *Abies bicolor*, Maxim. Mélang. Biol. Bull. Acad. St. Petersb. 6; Miquel, Prolus. Fl. Jap. 389; Franch. and Savat. Enum. 467, 1666; Rein, Japan. ii. 280, 23. *A. Menziesii*, Loud. Cat. of Plants, Koish. Bot. Gard. 1877, 92. *P. ajanensis*, Fischer, Yatabe, Cat. of Plants, Bot. Gard. 1877, 208.

Habitat.—According to Dr. Mayr, this Fir is not much more widely distributed than *P. polita*. It is only to be found in Central Japan from $35\frac{1}{2}^{\circ}$ to 38° N.; further north it does not exist. In a vertical direction, it belongs to the temperate and cold Conifer woods, but is also to be found here and there in the cold Beech forests in single specimens.

P. cærulea Hudsoni. It has not yet been determined to which species this variety belongs.

P. Engelmanni, Engelm. in St. Louis Trans. ii. 212. *Abies alba*, (?) Torrey in Fremont's Rep. 97. *A. nigra*, Engelm. in Sill. Journ. xxxiii. 330 (not Poir.). *A. Engelmanni*, Parry in St. Louis Trans. ii. 123. *Pinus commutata*, Parl. in DC. Prodr. xvi. 2, 417. *P. Engelmanni*, Engelm. in Proc. Am. Phil. Soc. new ser. xii. 209.

Habitat.—Peace River plateau, in latitude $55^{\circ} 46'$ N. (G. M. Dawson), through the interior of British Columbia, and along the Cascade Mountains of Washington Territory and Oregon to the valley of the Mackenzie River; along the principal ranges of the Rocky and Wahsatsh Mountains to the San Francisco Mountains, Sierra Blanco, and Mount Graham, Arizona.

A large tree, 80-150 feet in height, with a trunk 3-4 feet in diameter, or at its extreme elevation reduced to a low, prostrate

shrub ; dry, gravelly slopes and ridges between 5,000 and 11,500 feet elevation ; the most valuable timber tree of the central Rocky Mountain region, here forming extensive forests, generally above 8,500 feet elevation ; rare, and of small size, in mountains of Washington Territory, Oregon, and Montana.

The species, and the varieties also, thrive well in Denmark, but only young plants have as yet been observed.

P. Engelmanni glauca, hort. *Abies Engelmanni glauca*, hort.

P. excelsa, Link in Linnæa, xv. 517. *Picea*, Plin. Hist. Nat. xvi. 10. *P. Latinorum*, J. Bauh. Hist. i. 2, 238. *Abies tenuiore folio*, &c., Tourn. Inst. 585. *Picea major*, prima sive *Abies rubra*, C. Bauh. Pin. 493. *Pinus Abies*, L. Sp. Pl. 1421. *P. Picea*, Du Roi, Obs. Bot. 37. *P. excelsa*, Lam. Fl. Franc. ed. 1, ii. 202. *Abies Picea*, Mill. Dict. n. 3. *Pinus cinerea*, Röl. Deutschl. Fl. 376. *Abies excelsa*, DC. Fl. Franc. iii. 275. *Picea vulgaris*, Link in Abhandl. Berl. Acad. 1827, 180.

Habitat.—Europe, from almost the limits of arborescent vegetation in the north, at about latitude 68°, to as far south as the Alps and Pyrenees. With the exception of the last-named mountains, on which it is not very abundant, it is not known to be native south of latitude 45°, and it is not indigenous to Denmark, Holland, Britain, and Ireland.

The Spruce Fir is very common, especially in Scandinavia, and forms forests on the Alps, from east to west, and is principally found at a height varying from 4,000 to 6,500 feet of elevation, but it sometimes occurs as high as 7,000 feet, where it becomes very dwarf ; while, on the other hand, it has been found as low as 1,000 feet at Tolmezzo in Venice, but nowhere on the whole chain of the Apennines. It is also wanting in a natural state in the countries surrounding the Mediterranean, even on the mountains.

Gilpin, who was almost a cynic in his dislike of regularly formed trees, and who disliked the White Pine on account of its smooth bark, conical form, and the exact disposition of its branches, says of the Norway Spruce :—"The Spruce Fir is generally esteemed a more elegant tree than the Scotch Pine, and the reason, I suppose, is because it often feathers to the ground, and grows in a more exact and regular shape, but this is a principal objection to it. It often wants both form and variety. We admire its flowing foliage, in which it sometimes exceeds all other trees, but it is rather disagreeable to see a repetition of these feathery strata, beautiful as they are, reared tier above tier in regular order from the bottom of a tree to the top."

The timber of the Spruce is that known in the trade as "white deal," in contradistinction to "red deal," which is the wood of the Scots Fir ; and it receives a further denomination from the places whence it comes, as "Christiania white deals" have acquired a reputation for quality superior to that of others. It is exported in

various forms, according to the purposes for which it is intended. Entire trees, of good size, merely barked, and with a little of the sap-wood taken off, are exported for masts and spars. Entire trees of smaller size, again, are exported for poles. These are the younger trees which have been drawn up by growing close together, or near old ones. Squared planks of various length, breadth, and thickness, according to the size of the trees, are what are called "deals" and "battens." Deals are the longer of the two. They run about 12 feet long by $2\frac{1}{2}$ to 3 inches thick, and 7 to 9 inches wide. Battens, again, are from 2 to 7 inches wide, and from $\frac{1}{2}$ to $1\frac{1}{2}$ inch thick. In mercantile transactions 120 deals are reckoned as 100, and 120 deals of the larger size, $12 \times 9 \times 3$, are equal to $5\frac{3}{4}$ loads, and of the smaller size, $12 \times 9 \times 2\frac{1}{2}$, to $4\frac{1}{2}$ loads. Of the latter size 38 deals make a ton, and two tons make a last. It is very durable, being among Conifers in this respect, according to Loudon, next to the Larch—a statement which, however, we think must be taken with a qualification dependent on the rate and place of growth of the individual tree. Grown upon a dry soil the wood is brittle and short-grained, but grown on a dampish soil it is quite of an opposite character. Disregarding exceptional cases, however, its durability and tenacity make it excellently suited for palings and rough purposes, and leaving the bark on makes it last longer. On a comparison of the durability of the Spruce and the Scots Fir which have been used for rails, paling, fences, and gate-posts, at thirty years old, the Spruce Fir has been found to last two or three years longer than the Scots ("Pinetum Britannicum").

"There is a great diversity of opinion respecting the merits of this tree in a landscape. The objection is chiefly to the monotonous formality of its appearance; yet when it is in a situation highly artificial or extra-natural, as near ornamental buildings, on rugged, rocky places, or on the tops of informal hills, there is probably nothing more beautiful" (T. Meehan, "Handbook of Ornamental Trees").

Downing says the Norway Spruce is the great tree of the Alps, and as a park tree to stand alone we scarcely know a more beautiful one. Its fine sweeping feathery branches hang down in the most graceful and pleasing manner.

Introduced about 1548. It thrives well, attains to a great height, and is a very useful timber tree, the wood being light and elastic, and suitable for a variety of purposes. Its durability depends a good deal on the altitude at which it grows, the soil it grows in, and the management to which it is subjected. The colour of the wood is either a reddish or yellowish white, and contains much less resin than the Scots Pine. It weighs 65 lbs. 11 oz. per cubic foot when green, and 35 lbs. 2 oz. when quite dry. Its ashes furnish potash, and its trunk resin, from which Burgundy pitch is made. The timber takes a high polish, is used for gilding upon, and, like the Pear, takes a rich black stain. This tree is an excellent and cheap nurse, and,

being dense in the foliage, it may be said to be a storehouse of heat. It is of a conical form, and being an excellent non-conductor, it protects the ground from cold and drought. The tree luxuriates on north and east exposures in deep loams or a moist sandy soil, and on such it is believed to produce timber in Scotland equal, or almost so, to that grown in Norway (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

P. excelsa is to be found in Danish forests and gardens with a height of 100 feet and more. A forester told me that he had measured a tree, supposed to be 125 years old, which was 113 feet high and 11 feet and a few inches in girth.

P. excelsa, says Professor Schübeler, does not seem to reach in Scandinavia the height and thickness it attains in Germany—for instance, in the Erz Mountains of Saxony. Even there, under good conditions, one will seldom find trees more than 100 feet high (31·37 metres) with a diameter of 3 feet (94 cm.). The young growth is sometimes, even in northern situations, very considerable, being often over 2 feet.

P. e. aurea magnifica. A distinct, clear yellow variety, brought into commerce by Mr. Hans, nurseryman, of Hernhut.

P. e. brevifolia, Cripps (the Short-leaved Miniature Spruce). A distinct pigmy Spruce, with very minute leaves.

P. e. Clanbrassiliana, Carr.

This is a very distinct-growing variety, seldom or never exceeding 4 or 5 feet in height, but forming a compact, low bush, with short slender branches, which are densely covered with leaves that are little more than a quarter of an inch in length, of a needle shape, somewhat four-angled, their grooves tinged with a light glaucous hue. This plant was first introduced to Great Britain by Lord Clanbrassil, and is designated "*Clanbrassiliana*" in compliment to his lordship. It presents an interesting and curious appearance in the arboretum amongst the more gigantic-growing species belonging to the same genus.

Plants about thirty, perhaps forty, years of age are to be seen in Denmark. In rare cases I have seen a branch revert to the species, but perhaps it came from the stem on which the variety was grafted.

P. e. denudata, Carr. *P. excelsa virgata*, Jacq.

This variety, known as the Naked or Twig-branched Spruce, differs principally from the monstrous form of the common Spruce in the lesser branches being more twiggy, spreading, reflexed, and a little more divided at irregular distances, and in the leaves being stouter, and lying more closely along the branchlets. It is of French origin.

P. e. elegans, Loud. *P. elegans*, Smith. *P. excelsa dumosa*, hort.

A dwarf variety, with very slender grey foliage, only growing 4 or 5 feet high, with a very compact, pretty appearance.

P. e. eremita, Knight, Carr. *Abies miniata*, Knight.

A variety with short, stout branches, covered with a yellowish red

bark, and mostly solitary, or free from laterals ; the leaves are short, irregularly four-sided, somewhat two-rowed, from being reverted or bent backwards, and mostly blunt-pointed.

It nearly approaches *Abies excelsa monstrosa*, but is much less branching, and with the bark generally of a much redder colour.

P. e. finedonensis, Paul. *P. finedonensis*, hort.

A striking variety of the common Spruce, with all the younger leaves on the upper side of the shoots at first of a pale yellow, or straw colour, as well as the young wood ; but afterwards, as they get older, they change to a bronzy brown, and finally, when fully matured, become light green, while those leaves on the under side of the shoots and fully shaded branchlets are more or less green from the first.

This variety originated at Finedon Hall, in Northamptonshire, where it came up accidentally in a bed of seedling common Spruces.

P. e. Gregoryana, Paul. *Abies Gregoryana*, Low.

A very dwarf variety, seldom growing more than 1 or 2 feet high, but with numerous smallspreading and somewhat declining branchlets, thickly covered with short, stiff, needle-shaped leaves, placed obliquely all round the shoots, and of the same colour in all parts.

It was raised at the Cirencester Nursery, in Gloucestershire.

P. e. inverta, Smith. *Abies inverta*, Smith.

A pendulous variety of the common Spruce, in which the leading shoot straightens itself in the old wood, after the manner of the Deodar Cedar, but not so quickly ; the lateral branches on old plants are as drooping as the Weeping Willow, and the leaves are longer, larger, and of a brighter green than those of the common Spruce, of which it is only an accidental variety, obtained by Mr. Richard Smith, of the St. John's Nursery, Worcester.

This kind appears, according to the drawing of the original tree, distributed by Mr. Smith, to be superior in its more drooping habit to all the other forms of the Pendulous Spruce, of which there are several variations.

P. e. monstrosa, Loud. *Abies excelsa Cranstonii*, hort. *A. excelsa horizontalis*, hort.

A very singular variety, with the branches and branchlets thickened and mostly without laterals, and straggling in all directions.

P. e. mucronata, Loud. *Abies mucronata*, Rauch.

A dwarf-growing variety, with short, thick, dark green, sharp-pointed leaves, and distorted, irregular branches, rather crowded. It is of French origin, and very distinct. *P. excelsa mucronata*, Carr., is perhaps another plant.

P. e. nigra, Loud. *Abies Lemoniana*, Booth. *A. gigantea*, Smith. *A. excelsa gigantea*, hort.

This only differs from the common Spruce in having the leaves of an intense dark green, and stouter, and in the cones being very much longer and broader.

P. e. pendula, Loud. Encycl. of Trees, 1027. *Abies communis pendula*, Booth. *A. viminalis*, Alstroemer.

This only differs from the species in having all its branches and branchlets drooping, and the leaves rather longer.

P. e. pygmæa (the Dwarf Spruce), Carr. Conif. ed. 2, 334. *Abies excelsa pygmæa*, Loud. Encycl. of Trees, 1027. *A. pygmæa*, hort. *A. parvula*, Knight, Syn. Conif. 36. *A. minima*, hort. *A. minuta*, hort. *A. nana*, hort. *A. pumila*, hort.

A very diminutive variety, only growing a foot high, but spreading on the ground, and certainly one of the dwarfiest of all Firs.

P. e. pyramidalis, hort. *Abies pyramidalis*, hort. *Picea excelsa pyramidalis*, Carr. Conif. ed. 2, 330. *Abies excelsa pyramidalis*, hort.

This variety differs from the common Spruce in having its branches ascending, and frequently as much collected together as those of the Lombardy Poplar. A striking kind, on account of its compact, pyramidal form. Of French origin.

P. e. stricta, Loud. *Abies excelsa conica*, Keteleer. *Picea excelsa conica*, Carr. *Pinus Picea conica*, Endl.

A very neat dwarf variety, quite conical in shape, and not more than 3 or 4 feet in height, with the branches and branchlets erect and numerous. Leaves slender, very closely compressed, bright green, marked along the sides with glaucous lines, and seldom more than half an inch in length, and terminating in a slender point. It is a very nice, compact variety.

P. e. tenuifolia, Loud. (the Slender Spruce). *Abies excelsa attenuata*, hort. *A. gracilis microphylla*, hort. *A. microphylla*, hort.

This variety differs in having very thin, slender leaves, and attenuated branches, with few branchlets.

P. e. variegata, Loud. *Abies excelsa foliis variegata*, Loud.

This differs in having some of its leaves, and occasionally some of the lesser branchlets, pale yellow or whitish in colour, intermixed with the ordinary green foliage of the plant. *Abies excelsa aurea*, introduced by Messrs. J. & C. Lee, is probably a richer variety of the above.

P. Glehnii, Masters, Gard. Chron. March 6, 1880, p. 300, f. 54; Linn. Journ. xviii. 512; Yatabe, Cat. Pl. Herb. Tokio, 208; Mayr, Monogr. der Abietineen des Japanischen Reiches, 1890, p. 56, 4, fig. 11. *Abies Glehnii*, Fr. Schmidt, Reisen im Amurlande und auf der Insel Sachalin, 1868, 176, cum ic. *A. obovata* var. *japonica*, Maxim. Ind. Sem. Petrop. 1866; Veitch, Man. Conif. 80. *Picea japonica*, Regel, Ind. Sem. Petrop. 1865.

Habitat.—It was found by Glehn, who accompanied F. Schmidt in his travels in Sachalin and in Amurland. It does not occur in Northern Sachalin, but in the south, and also near to Eso, in great numbers. On Eso itself this Fir reaches its highest development,

and there are certainly a greater number to be found there than in all Central Japan combined.

Seems to be hardy.

P. kondoensis, H. Mayr, Monogr. d. Abietineen des Japan. Reiches, 1890, 51, 4, f. 9.

Habitat.—The real Tohi is only to be found on the high mountains of Central Japan, from $35\frac{1}{2}^{\circ}$ to 38° N. It is not to be found more northerly. It belongs to the temperate cool region. With *P. bicolor* it forms mixed forests on the Fuji-san, and on the Ontake and other mountains of Central Japan and Kiso; on the Nantai-san, near Nikko, it extends higher up than Birches, Beeches, and Oaks, and it is there found mingled with *Tsuga diversifolia*.

P. jezoensis, Carr. Tr. Gén. Conif. ed. 2, 345. *Abies jezoensis*, Sieb. and Zucc. Fl. Jap. ii. 19, t. 110. *Pinus jezoensis*, Ant. Conif. 97, t. 37, f. 1.

This species Dr. Mayr identifies with *Picea ajanensis*, Fisch.

As our plants in Denmark are still young, I think it right to keep the above name to them for a time.

P. microsperma. *Abies microsperma*, Lindl. in Gard. Chron. Jan. 1861; Veitch, Gard. Chron. April 1862; Gord. Pinet. Suppl. 12 (*descrip. falsa*); A. Murr. fil. Pines and Firs of Japan, 69, figs. 129-133.

This plant Dr. Mayr also believes to be identical with *P. ajanensis* (like the *P. jezoensis*), but I think it best still to keep the above name to our young plants during observation, until a correct determination can be arrived at.

P. Morinda, Link in Linnæa, xv. 522. *Pinus Smithiana*, Lamb. Pin. iii. t. 88. *P. Khutrow*, Royle, Illustr. of Himal. Bot. 353, t. 84, f. 1. *Abies Smithiana*, Forb. Pinet. Wob. 103, t. 30. *A. Khutrow*, Loud. Encycl. of Trees, 1032, f. 1931. *A. spinulosa*, Griff. Journ. of Travels, 259, 265, 275. *A. pendula*, Griff. ex Gord. Pin. Suppl. 7. *A. Morinda*, hort. *Picea Khutrow*, Carr. Conif. ed. 1, 258. *Pinus Morinda*, hort.

Habitat.—The Himalayan Mountains from Bhotan (7,800 to 10,500 feet) to Cashmere, and throughout the whole of the forests from the Kuram district to Seratigah, in Afghanistan, at elevations ranging from 8,000 to 12,000 feet. Rare in Sikkim, at elevations of from 8,000 to 11,000 feet (Hook. fil. and Thompson).

Introduced into Scotland in 1818 by Dr. Govan, of Cupar, who sent cones to the Earl of Hopetoun. From the seeds of these cones the first plants, six in number only, were raised.

A magnificent tree, found on the lofty mountains of the interior, from Bhotan up to Kafiristan, at elevations of from 7,000 to 12,000 feet, and it is not only a very superb, but a very graceful tree. The boughs ascend a little in the young trees, but are horizontal in the older ones, and from these the branchlets and smaller twigs droop in the most

graceful manner. It prefers a north aspect, and attains a great height in favourable situations, frequently from 100 to 150 feet high. Capt. Hodgson measured a fallen tree in 1830 and found the length 169 feet (G. Gordon, "The Pinetum," 1875).

The economic value of *P. Morinda* does not appear to be very great. Sir J. D. Hooker notes that "it has white wood, employed for posts and beams," but the timber is soft, and, although free from knots, is very perishable (Gordon, "Pinetum," p. 21). Dr. Royle states that a very fine resin is secreted in the cones, which, no doubt, would yield a superior turpentine ("Botany of the Himalayan Mountains," p. 352).

It is the most graceful Fir met with on the Himalayas, on account of its long drooping branchlets and great dimensions. It sometimes measures from 18 to 20 feet in girth four feet from the earth's surface, and towers 150 feet or more into the heavens. Its wood is soft and open-grained, and when converted into boats is said not to last more than five or six years.

In the Himalayas this Fir is called "Morinda" (nectar, or honey of flowers), on account of the resinous drops or tears found on the young cones and other parts of the tree, resembling honey. The mountaineers about Simla call it "Rai," "Re," "Rhai," and "Ray-ung"; and the people of Gurhwal, "Realla," "Rhei," and "Rayha," all variations in their dialects for Fir-tree, Prickly Fir, and Wood Pine. It is also called by the same people "Roo," "Roo-ee," and "Row," all signifying to weep or shed tears, either on account of its resinous drops or the drooping appearance of the full-grown trees. Dr. Royle's barbarous local name, "Khutrow," should either be "Koodrow" (Weeping Fir) or "Koodrai" (Prickly Fir), its true vernacular names about Simla, of which Dr. Griffith's temporary botanical one, *spinulosa*, is a translation. In the Simla jurisdiction it is styled "Row" and "Rai," and in the Kohistan of the Punjab, and in Kooloo, "Koodrow"; but in Kamaon and Gurhwal "Morinda" and "Koodrai" are its more common appellations. The tree is a very sombre figure in the landscape.

No one should attempt to introduce this tree unless every care and attention can be bestowed upon it after planting, having first selected a congenial spot. The Himalayan Spruce is almost invariably found on the northern declivities of the mountains in its native country, and therefore requires either a partially shaded aspect or a northern exposure. In the latter case, if a belt of evergreens or other protection be afforded, fine specimens may be obtained, but as it belongs to that class of uncertain trees, neither tender nor yet entirely hardy, care is absolutely necessary to induce it to thrive properly. A slight protection of evergreen boughs, tied quite loosely over it during the winter, is all that is required; or, in the case of young plants, the boughs may be allowed to remain during the summer

months, care being taken in this instance to admit plenty of air and light (Hoopes, "Evergreens").

Picea Morinda planted in Danish gardens in 1852 now has a height of 27½ feet and a girth of 2 feet 8 inches. One planted in 1864 now measures 15 feet in height and 1 foot in girth. Taller ones than these have been seen. Cones are often produced on trees of this species in Denmark.

I have observed this species in several countries in Western Europe, and in every instance it seems to thrive well. I have also observed it in several parts of Denmark, where it develops well everywhere. The hard and long winter of 1890-91 did not do the tree any apparent harm. I observed one of about the age of twenty years standing together with many young trees of the same species. All looked well, although close by were trees of *Abies pectinata*, *Pinus Laricio*, *Taxus baccata*, and *Juniperus communis* which had some dead branches. It is interesting to know that the most southern *Picea* is so hardy in Denmark.

P. nigra, Link in Linnæa, xv. 520. *Abies Piceæ, foliis brevioribus*, &c., Mill. Dict. Ic. t. 1. *A. Mariana*, Mill. Dict. n. 2. *A. marylandica*, hort. *A. nigra*, Michx. fil. Arb. Forest. d'Amer. Sept. i. 123, t. 11. *A. denticulata*, Poir. Dict. vi. 520. *Pinus nigra*, Ait. Hort. Kew. ed. 1, iii. 370. *P. Abies canadensis*, Marsh. Arb. 103. *P. Mariana*, Du Roi, Obs. Bot. 38. *P. marylandica*, hort. *P. americana nigra*, hort. *P. a. rubra*, Wangenh. Amer. 75. *Abies nigra* var. Michx. fil. l.c.

Habitat.—Newfoundland, Northern Labrador to Ungava Bay, Nastapokee Sound, Cape Churchill, Hudson Bay, and north-west to the mouth of the Mackenzie River and the eastern slope of the Rocky Mountains; south through the Northern States to Pennsylvania, Central Michigan, Wisconsin, and Minnesota, and along the Alleghany Mountains to the high peaks of North Carolina.

An important tree (called "Double Spruce" by the Canadians, a third part of their forests being exclusively of this species), 50-70 feet in height, with a trunk 2-3 feet in diameter; light, dry, rocky soil, forming, especially north of the fiftieth degree of latitude, extensive forests on the watersheds of the principal streams, or in cold, wet swamps; then small, stunted, and of little value.

Wood light, soft, not strong, close, straight-grained, compact, satiny; bands of small summer cells thin, resinous; resin passages few, minute; medullary rays few, conspicuous; colour light red or often nearly white, the sapwood lighter; specific gravity, 0.4584; ash, 0.27; largely manufactured into timber, and used in construction, for ship-building, piles, posts, railway ties, &c. (C. S. Sargent).

The foliage of *P. nigra* (or, as it is often called, *P. Mariana*) is dark green and gloomy in appearance, occasioning the popular appellation of Black Spruce.

This species is well described in the "*Sylva Americana*"; it is there said to attain the height of 70 or 80 feet. The distinguishing properties of the wood of Black Spruce are stated to be strength, lightness, and elasticity. Introduced into England about the year 1700 by Bishop Compton.

The Black Spruce holds relatively the same position, in an economic sense, among the coniferous trees of North-east America as the Norway Spruce does among those of Europe. Its timber is of excellent quality, light, strong, and elastic; durable when protected, but decaying rapidly when exposed to the weather. It is more used in the Dominion of Canada and the adjacent portions of the United States than that of any other coniferous tree; it is also exported to Great Britain in large quantities, chiefly to the ports of Liverpool and Glasgow. The consumption of Black Spruce timber is known to be enormous, many thousands of acres being cleared annually to supply the demand.

The Canadian French call the Black Spruce "*Epinette à la Bière*," because the twigs of the tree used to be boiled in water with other substances, such as sugar, molasses, &c., and the liquor being casked and fermented, received the name of spruce beer.

The ornamental qualities of *Abies nigra* are not of a very high order, although it possesses some very distinctive characters, but these are only well developed in this country when the trees are growing in retentive, loamy soils and moist places, freely exposed on all sides. In the New England States and adjoining provinces of Canada, where the Black Spruce is most abundant, it is found to "delight in cold, hilly, and mountain regions, attaining its largest size in those moderate elevations, ridges, or slopes where the soil has a ready drainage, and at the same time retains considerable moisture by reason of its mossy-shaded surface and large percentage of dark vegetable mould. It also grows freely in low swampy lands and about sphagnous marshes, but in such localities it is inferior in size and quality."

"The Black Spruce is much disposed to be variable. In open sphagnous marshes a form occurs so marked in its appearance that in some localities it has received the name of the Bastard Spruce. The branches of this variety are generally slender, the internodes short, and the leaves pale. The tree has a feeble, starved, and sickly aspect, and does not attain a large size. Another form occurs in the Adirondack region; the foliage has a silvery or glaucous hue, on which account it is sometimes mistaken for the White Spruce. The most remarkable variety is found on the highest summits of the Adirondacks. It is the variation of the tree into a mere procumbent shrub, so small that it offers but little impediment to him who would walk over it. These bushes are more or less flattened in outline, the branches issuing nearly from the opposite sides of the trunk, as in the

Ground Hemlock. They grow in dense patches, completely covering the ground, and in numerous instances with their apices all pointing the same way. They have the short internodes and the short pale leaves of the Bastard Spruce." (From a Paper on *Abies nigra*, read before the Albany Institute by C. H. Peck, Esq.)

It has long been known in Europe ; and Josselyn, in his "History of New England," published in London in 1672, informs us that it was considered at that period to furnish the best yards and topmasts in the world.

Cones being frequently imported, the tree is abundant in British nurseries, and has been generally distributed as an ornamental tree ; which it hardly merits, save on account of the colour of its cones when young and the dense habit of growth of the tree.

The Black Spruce, according to Pursh, is of "great mechanical use" in America, besides being "the tree of which that wholesome beverage called spruce beer is made." Michaux says "the distinguishing properties of the Black Spruce are strength, lightness, and elasticity." In the dockyards of the United States the spars are usually of Black Spruce from the district of Maine, and it is exported in great quantities for the same purpose to the West Indies and Liverpool. The knees of vessels at Boston and in the district of Maine are sometimes made of the base of this tree and one of the principal roots ; and it is substituted for Oak in many places where the timber of that tree is becoming scarce. In Maine and Boston it is often employed for the rafters of houses, and is more esteemed for that purpose than even the Hemlock Spruce. It is sometimes used for floors, for which purpose it is found tougher than the White Pine, *P. Strobus*, but is more liable to crack. In all these regions, but particularly in Maine and New Brunswick, the Black Spruce is sawn into boards of considerable width, which are sold a fourth cheaper than those of White Pine, and are exported in great quantities to the West Indies and to England, being used in the latter country, principally at Birmingham and Manchester, for packing-cases. This species is not resinous enough to afford turpentine as an article of commerce, and the wood snaps when burning like that of the Chestnut.

The following is the method given by Duhamel for making spruce beer : "To make a cask of spruce beer a boiler is necessary which will contain one-fourth part more than the quantity of liquor which is to be put into it. It is then filled three parts full of water, and the fire lighted. As soon as the water begins to get hot, a quantity of Spruce twigs is put into it, broken into pieces, but tied together into a faggot or bundle large enough to measure about 2 feet in circumference at the ligature. The water is kept boiling till the bark separates from the twigs. While this is being done, a bushel of oats must be roasted, a few at time, on a large iron stove or hot plate ; and

about fifteen galettes, or as many sea-biscuits, or if neither of these are to be had, fifteen pounds of bread cut into slices and toasted. As these articles are prepared, they are put into the boiler, where they remain till the Spruce Fir twigs are well boiled. The Spruce branches are then taken out, and the fire extinguished. The oats and the bread fall to the bottom, and the leaves, &c., rise to the top, where they are skimmed off with the scum. Six pints of molasses, or 12 to 15 lbs. of coarse brown sugar, are then added, and the liquor is immediately tunned off into a cask which has contained red wine; or, if it is wished that the spruce beer should have a fine red colour, five or six pints of wine may be left in the cask. Before the liquor becomes cold, half a pint of yeast is mixed with it, and well stirred, to incorporate it thoroughly with the liquor. The barrel is then filled up to the bunghole, which is left open to allow it to ferment, a portion of the liquor being kept back to supply what may be thrown off by the fermentation. If the cask is stopped before the liquor has fermented twenty-four hours, the spruce beer becomes sharp, like cider; but if it is suffered to ferment properly, and filled up twice a day, it becomes mild and agreeable to the palate. It is esteemed very wholesome, and is exceedingly refreshing, especially during summer." (Duham. Arb. i. 17). According to Michaux, "the twigs are boiled in water, a certain quantity of molasses or maple sugar is added, and the mixture is left to ferment." The essence of spruce (of which spruce beer is made in America) is obtained "by evaporating to the consistence of an extract the water in which the ends of the young branches of Black Spruce have been boiled." Michaux adds that he cannot give the details of the process for making the extract, as he has never seen it performed; but that he has often observed the process of making the beer in the country about Halifax and in Maine, and that he can affirm with confidence that the White Spruce is never used for that purpose. He also states that spruce beer is considered very wholesome, and in long voyages is found efficacious in preventing attacks of scurvy.

Picea nigra (Black Spruce) has little to recommend it to the British arboriculturist, either as an ornamental or commercial tree. At certain stages of growth, and when planted in peculiar situations, there is a certain beauty about this Spruce, but as usually seen in this country it is of meagre appearance and ill adapted for ornamenting our parks and woodlands (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

P. n. pumila, Knight. *Abies nigra fastigiata*, hort. *Picea nigra fastigiata*, Carr.

A dwarf variety, growing 3 or 4 feet high, and rather slender, with smaller foliage and a more compact habit.

P. obovata, Ledeb. Fl. Altaic. iv. 201, and Ulust. t. 499. *Pinus obovata*, Ant. Conif. 96, t. 37, f. 2. *P. Abies*, Pall. Fl. Ross. i. 6 (excl. syn.). *Abies obovata*, Loud. Arb. Brit. iv. 2329. *A. excelsa*.

var. *obovata*, C. Koch, Dendr. ii. 238. *Picea vulgaris* var. *altaica*, Teplonchoff, Bull. Soc. de Mosc. ed. 1, xli. 250.

Probably this name is only correct for those plants of *Picea obovata* that grow in Northern Europe, viz. *Picea excelsa medioxoma*, Nylander, which form is very well illustrated in the "Pinetum Britannicum."

Habitat.—Siberia, from the Ural Mountains to Dahurica, and from the Altai Mountains—where it forms vast forests from the base to 4,000 feet elevation—to the arctic regions as far as lat. 69° 30' N.; also in Northern Europe.

It is called "Kara-Schersæ" by the Tartars on account of its warted branches and close appearance, and is a very different kind from the *Abies orientalis* which is so frequently substituted for it in nurseries. It more resembles the common Spruce, but with very much smaller egg-shaped cones, which are quite obtuse at the ends, and seldom more than 2½ inches long by 1¼ wide.

Some authors deem this plant to be only a variety or mountain form of *P. excelsa*. Dr. Ügo Dammer has written on this question in the *Gartenflora*.

We have probably more than one form of *P. obovata* in Denmark among the so-called "Nordlands-Graner," raised from seeds received from more northern parts of Europe.

Hardy.

P. Omorika, Panic. C. Bolle, Monatsb. des Vereines zur Beförderung des Gartenbaues, 1877; Reichenbach in Botanische Zeitung, 1877; Gard. Chron. April 14, 1877, 470, May 19, 1877, 620, and March 8, 1884, 308; Ascherson, Sitzb. der Gesells. Naturfreunde zu Berlin, 1881; Boissier, Fl. Orientalis, v. 701 (sub *P. orientali obiter*). *Pinus Omorica*, Panic.

Habitat.—Mountains of South-western Servia, in Bosnia and Montenegro; also in Western Bulgaria.

Picea orientalis, which has been compared with it, has shorter leaves, more acutely pointed and more four-sided in section. The cells also which surround the central bundle-sheath are in *P. orientalis* of an oblong form, and radiate from the central bundle on all sides. Their walls are undulated. Hence, then, the superficial appearance, no less than the internal structure of the leaves, is quite distinct in the two species; a comparative examination of which, therefore, confirms Dr. Panic's view that he had to do with a previously undescribed species, and not with a form of *P. orientalis*. Moreover, the cones of *P. orientalis* are longer and the scales broader than in *P. Omorika* (Maxwell T. Masters, "Contributions to the History of certain Species of Conifers").

Recently introduced into Northern Europe; the first tree was planted in Denmark in 1890.

Hardy.

P. orientalis, Link and Carr. Man. des Pl. iv. 340. *Pinus orientalis*, Linn. Spec. Plant. 1421. *Abies orientalis*, Poir. Dict. vi. 518.

Tournefort found this species growing about twenty-five miles to the south-east of Trebizond. He there found it pretty high up the mountains. He says: "After having visited the environs of the convent, where there are plants which interested us in the most agreeable manner, we ascended to the most elevated places, which the snow had only left a few days previously, and where we saw others which were yet loaded with it. The people of the country call the common Firs 'Nevkos,' which differ in nothing from those which grow on the Alps and the Pyrenees; but they have preserved the name 'Eyatn' for another fine species, which I had not previously seen except around this monastery." Stevens records it as growing on the summits of the Imeritian Mountains in Upper Mingrelia, also between Gurriel and the Adscharenzen Mountains. Lambert gives figures of the details of specimens which he had received from China and the neighbourhood of Tiflis, and which he thought belonged to this species; but it has been doubted whether either of these truly belongs to it, and one of them certainly does not. Consequently, the habitat of this species, so far as yet known, does not extend greatly beyond the regions to the east of the Black Sea, Trebizond not lying very far from its south-east corner.

The usually dense habit of this Spruce, combined with its deep dark green foliage, which is perfectly distinct from that of any other Conifer, renders it of great value for contrasting with other trees of a more light and airy appearance. Although of slow growth and doubtful value as a forest tree, still for ornamental planting, particularly for lawns of small extent, or where larger trees would be out of place, this Spruce is of particular value, and cannot fail to attract attention and win the admiration of the lovers of trees. As scarcely half a century has elapsed since its introduction no trees have reached maturity, although specimens of fully 50 feet in height are not uncommon. When grown under favourable circumstances, the Eastern Spruce makes an annual upward growth of about 17 inches. A specimen growing on gravelly loam, with a surface coating of decayed vegetable matter, and in a sheltered situation, has attained to the height of 47 feet in twenty-nine years, and in that time has produced about 30 feet of timber. The few specimens of wood I have examined were of good quality, the graining and texture resembling closely its near ally, the Norway Spruce. As a timber tree it will never rank high with us, but as an ornamental and perfectly hardy tree it merits greater attention than it has received. The date of introduction is not certain, but it is supposed to have been about 1838. Nearly three hundred years before, in 1553, however, it was noticed by Bellon, who visited its native country. Habitat,

Mount Taurus and the Caucasian region (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

In short, its habitat might be stated thus: Eastern and south-eastern shores of the Black Sea, Taurus and the Caucasus, Imeritia, Mingrelia, between Adschar and Gurriel. Abundant near Trebizond.

Introduced into Great Britain in 1839 (Lawson's "Pinetum Britannicum:" *Abies orientalis*, p. 3). Some authors say that it was introduced into Europe in 1837.

P. orientalis planted in 1849 in Denmark now measures 49 feet in height and 4 feet in girth. Larger trees are probably to be found in Danish gardens; one has been estimated at 53 feet. It has done well at Stockholm and Upsala.

P. polita, Carr. Tr. Gén. des Conif. 256; Masters, Linn. Journ. xviii. 507; Nakamura, Ueber den Anat. Bau der w. j. Conif. xvii. 26; Matsumura, Nippon Shokobutzumei, Tokio, 140, 1628; Desc. Cat. Exhib. Edinburgh, 253; Yatabe, Cat. of Plants, Herb. Tokio, 187; Cat. of Plants, Bot. Gard. Tokio, 208; Tanaka Jō, Dai Nippon Shokubutsu-tai; San-rin-kai, 91, 1, 20. *Abies polita*, v. 212, Sieb. and Zucc. Fl. Jap. ii. 20; Lindl. and Gord. Journ. Hort. Soc. v. 212; Murray, Pines and Firs of Japan, 77; Miquel, Prolus. Fl. Jap. 331, 3; Yoyo moku-sai shoran, 22; Franch. and Savat. Enum. 466, 1665, i.; Hoopes, Evergreens, 181; Cat. of Plants, Koishikawa Bot. Gard. 92; Nippon Chumoku-shi riyaku, 17; Le Japon à l'Exposition Univ. 110, 18; Gord. Pinet. 16; Veitch, Man. Conif. 77; I. Rein, Japan. ii. 280, 24. *Pinus polita*, Ant. Conif. 95, t. 36; Endl. Syn. Conif. 121; Parl. in DC. Prodr. xvi. 2, 417; Abies Thunberg, Fl. Jap. 275. *Abies Torano*, Sieb. Syn. Pl. Occ. 58; Verhandlungen van het Batav. Genotsch. xii. 12; Koch, Dendr. ii. 233, 19. *A. Thunbergii*, Lamb. *A. Smithiana*, Gord. Pinet.; Hoopes, Evergreens. *Picea Smithiana*, Lamb. Engl. and Prantl, ii. 1. *P. Khutrow*, Carr. Willk. Forstl. Fl. 95. *Abies Khutrow*, Loud. Encycl. of Trees, 1032, f. 1931; Henk. and Hochst. 199; Mayr, Monogr. Abiet. Jap. 1890, 46, 3, f. 7.

Dr. Mayr, who has collected the above notes on its literature, says: "It is a question if it was not the *bicolor* Spruces instead of the *polita* that caused the five last-named authors to believe that the Himalayan Spruce was distributed in Central Japan; but with the sparingly given notes in the works cited it is impossible to decide this question.' The last five synonyms therefore seem unnecessary.

Habitat.—Corea and Japan. Dr. Mayr says that in almost all botanical works the habitat given is wrong. It is not to be found in Japan further north than 38°. It is at home neither on Eso nor on the Kuriles. It is always isolated, mixed with leaf-trees, and it forms no groups or forests of itself. It is rare over the whole of Japan, of no great value as a forest tree, and is, so to say, not in use.

Most of the Japanese do not even know the name. Dr. Mayr further says that he has not found trees more than 120 feet high.

It is hardy in Denmark.

Introduced in 1861 by Mr. J. G. Veitch (A. Murray, Pines and Firs of Japan, 80; Sieb. and Zucc. Fl. Jap. 21).

P. pungens, Engelm. Watson in Fl. Calif. ii. 122; Carr. Observ. ad *P. sitchensis*; Sargent, Woods of the United States, No. 385. *P. Parryana*, Barron. *P. commutata*. *Abies pungens*, Engelm.: *A. Parryana*, hort.

The White Spruce and Blue Spruce of North America.

Habitat.—Valley of the Wind River, south through the mountain ranges of Wyoming, Colorado, and Utah.

A tree 120–160 feet in height, with a trunk 2–3 feet in diameter; borders of streams, in damp or wet soil, generally between 6,000 and 9,000 feet elevation, never forming forests or reaching as high elevations as the allied *P. Engelmannii*; rare and local.

Hardy.

P. rubra, Link in Linnæa, xv. 521. *Pinus rubra*, Lamb. Pinet. ed. 2, 43, t. 28, and ed. 3, 66, t. 38. *P. americana rubra*, Wangenh. Beitr. 75, t. 16, f. 80. *P. americana*, Gaertn. de Fruct. et Sem. ii. 60, t. 91. *Abies rubra*, Poir. Dict. vi. 520. *A. americana rubra*, hort. *A. arctica*, Cunn. ex Gord. Pinet. 11.

Habitat.—North-eastern North America, in Nova Scotia and Newfoundland, and in the extreme northern parts of the same continent, around Hudson's Bay as far as the arctic regions, where it only forms shrubs, the last vestige of arborescent vegetation. Its timber is said to be excellent.

It is frequently confounded with *Picea excelsa*, and is certainly not easily distinguished from it, except when producing cones, when its characteristic marks are very conspicuous, the cones of the Norway Spruce being six times the size of those of the American one. I find it is a mistake for some botanists to regard it as *Picea nigra*, or a form of this species, from which it is very different.

A tall tree, varying in stature according to soil and situation. In deep loamy soil, and in a favourable situation, it grows 70 or 80 feet high, while in the cold arctic regions it becomes a small bush.

Hardy. Has frequently produced cones in Denmark.

P. r. cærulea, Loud. *Abies cærulea*, Lodd. *A. rubra violacea*, Loud. *Pinus rubra violacea*, Endl. *Picea cærulea*, Link.

This is a more slender and dwarfer variety, growing only 6 or 8 feet high, with bluish-grey foliage and violet-coloured cones.

P. Schrenkiana, Fisch. and Mey. Plant. Schrenk. ii. 12. *Pinus Schrenkiana*, Ant. Conif. 97. *Abies Schrenkiana*, Lindl. and Gord. Journ. Hort. Soc. v. 212. *Pinus obovata* β *Schrenkiana*, Parl. in DC. Prodr. xvi. 2, 415. *Picea obovata Schrenkiana*, Carr. Conif. ed. 2, 388. *P. obovata* β *Schrenkiana fol. longioribus*, Masters, Conif.

of Jap. 506. (1) *P. thianschanica*, Rupr. Sertum Thianschanicum, 72. *Pinus orientalis* β *longifolia*, Ledeb. Fl. Ross. iii. 671.

Habitat.—*Picea Schrenkiana* is a native of the Altai Mountains and South-west Siberia.

A tall tree, resembling *Abies Menziesii*, and in favourable situations growing 80 feet high, but diminishing in stature according to situation, soil, and elevation.

Hardy.

P. sitchensis, Traut. and Mey. Forul. Ochotensis, 1856; Carr. Conif. ed. 1, 260. *Pinus Menziesii*, Dougl. Msc. Lamb. Pinet. iii. t. 89. *Abies Menziesii*, Loud. Arbor. iv. 2321. *A. sitchensis*, Lindl. and Gord. Journ. Hort. Soc. v. 212. *Pinus sitchensis*, Bong. in Mém. Acad. St. Petersb. vi. ser. 2, 104. *Picea Menziesii*, Carr. Conif. ed. 2, 318. *P. sitkaensis*, Mayr in Wald. N. Am. 338.

Habitat.—Alaska, south to Mendocino County, California, not extending more than fifty miles inland from the coast.

A large tree, of great economic value, 155–200 feet in height, with a trunk 10–15 feet in diameter; gravelly ridges and swamps, reaching its greatest development in Washington Territory and Oregon, near the mouth of the Columbia River; here forming a belt of nearly continuous forest growth of fifty, or farther north and south rarely more than ten or fifteen, miles in width.

Wood light, soft, not strong, close, straight-grained, compact, satiny; bands of small summer cells narrow, not conspicuous; resin passages few, obscure; medullary rays numerous, rather prominent; colour light brown tinged with red, the sapwood nearly white; specific gravity, 0.4287; ash, 0.17; largely manufactured into lumber, and used for construction, interior finish, fencing, boat-building, the dunnage of vessels, cooperage, wooden ware, &c. (C. S. Sargent).

Introduced in 1831 by the Royal Horticultural Society through their collector, David Douglas.

In Oregon and Washington Territory *P. sitchensis*, in company with the Douglas Fir and *Thuja gigantea*, is one of the principal trees that form the dense coating of vegetation that covers the coast range of mountains; but it never attains dimensions so gigantic as those of the Douglas Fir. Its timber is of excellent quality, and is used by the settlers for various kinds of carpentry.

The Tide-land Spruce, being so accessible to early voyagers, was collected by the first visitors to the north-west coast, and it has received half-a-dozen scientific names, as it was classed in different ways. At last separated from the other Spruces by the French botanist Carrière, and named from one of the localities of its first discovery, on the island of Sitka (J. G. Lemmon, "California State Board of Forestry," 1889–90).

It does not attain to the size of the Douglas Fir in its native country, but its timber is of excellent quality, and is used for a great

variety of purposes. In suitable sites in Britain, and in deep moist loam, it is a rapid-growing and very handsome tree, its beautiful silvery foliage and long wavy branches being very attractive in ornamental grounds. It is of a wide-spreading habit, and the branches require plenty of room to fully develop their graceful proportions. Some of the finest specimens in Scotland are growing in the policies at Castle Menzies, in Perthshire. As a timber tree it promises to be one of the best of recently introduced Conifers (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

Carrière, in his "Traité général des Conifères," 1st edition, p. 260, calls this Spruce *Picea sitchensis*. In the second edition of the same work (p. 318) he calls the tree *Picea Menziesii*, Carr. And there he mentions the variety *Picea Menziesii crispata*, Carr. (Antoine, Conif. t. 33, f. 2). He says the species was introduced in 1831, and is very hardy. In the description he only gives the tree a height of 40-50 feet, which makes me think that the tree he observed was either very young or, perhaps, the fine blue but more dwarf variety, *Picea sitchensis speciosa*. He makes the following observation: "*Picea Menziesii* is seldom beautiful in cultivation except when it thrives well, and only when it is young. It soon loses the leaves on its lower branches, or they remain dead on the branches, which is not attractive. It is rare that this species attains a height of 25-35 feet. Really it is only a large shrub."

In nursery catalogues especially, *Picea sitchensis* has often been, and is still sometimes, mistaken for *Picea pungens*, Engelm.

The silver-white variety is still often called *Picea* (or *Abies*) *Menziesii argentea*. From Carrière's above-cited notes as to the size of the tree we might also perhaps suppose that he had observed a plant growing on ground not suited to the tree. On different soils the tree changes its character, especially of the leaves, or rather needles. I have observed the tree under very different circumstances, and have noticed that sometimes the needles, and also the branches, are more or less stiff, sometimes even rather soft, and thus they change in colour. I do not believe that it is only the soil which makes such alterations. The tree does not seem to demand much from the ground; in somewhat poor ground in Denmark young plants have thriven very well, at least for some years, and have even grown faster than any other species. Some authors and nurserymen believed that the two names *Picea sitchensis* and *Picea Menziesii* (sometimes with the generic names of *Abies* and *Pinus*) were not synonyms, but that they belonged to two different species, although it was admitted that they might be closely allied. One species, *Picea Menziesii*, would then be the slow-growing one, and Carrière's above-cited remarks might make some people believe this. This one should have its home in Northern California. The other one was then believed to grow much faster and taller. Now, however, most authorities agree that there is only one species.

If there be much variation in the growth of the plants, it can only come from a different manner of propagation, from the quality of the seed, or from the locality where this has been collected. Perhaps seeds from warm localities, either in the area where the species grows wild or from plants cultivated in the south, do not give such healthy or vigorous and tall plants as the seeds ripened in the north are likely to do. The name *P. sitchensis*, as Bongard had already called the tree in 1833, will thus have to be adopted. In America this name also seems to be the one most common. It was only in 1837 that Douglas gave the other name to the tree. Endlicher described *Picea sitchensis*, Bongard, in his "Syn. Conif." p. 123, as a species then not sufficiently known.

That the ground has some influence on the appearance of the plants has been proved in the well-known gardens of the former Court-Marshall and President, Saint Paul Illare, at Fischbach, in Silesia. There, in a mountain climate and in stiff, loamy, and perhaps clayey ground, plants 5 feet high, obtained from Dutch nurseries with light soil, and of the soft-leaved form they called *Menziesii*, became in about three years' time very stiff-leaved and prickly.

We have in Denmark in any case two forms—the real species, which grows very tall (as notes following will show), and the beautiful light blue, but not tall-growing variety, *P. sitchensis speciosa*. This variety is probably of little value for profitable planting, but it is very beautiful in gardens and pleasure grounds. It is perhaps the best of all Spruces, and ought, I think, to be planted in very great numbers, if the seeds could be obtained somewhat cheaper. Some of the best plants I have seen are in the plantations of Mynheer Schober at Utrecht. In his grounds at Schavenhorst, in Gelderland, on light soil, he has trees with stems of the thickness of $7\frac{1}{2}$ feet near the base, and at the height of 3 feet from the ground a circumference of $5\frac{1}{2}$ feet.

From some parts of Northern Germany, particularly from Zöschen (see *Gartenflora* for 1892), very unfavourable reports are given; but such mishaps in culture seem to be rare.

In some reports it is stated that the branches of the older parts throw out shoots, which is also the case with *Pinus rigida*. Schober has, among others, observed this; and he also mentions that there is a difference in growth between the less hardy plants raised from seeds collected in warm coast climates and the hardy plants raised from the seed of trees grown on mountains; these are the fast-growing, which he calls *P. Menziesii*.

P. sitchensis seems to produce cones in nearly all countries in the West of Europe. In Denmark it has done so for several years, but not in such great quantities as *P. alba* often does. Those first developed do not generally yield germinating seeds. Plants raised from home-grown seeds are still rare. Some imported plants here seem to have

been grafted on *P. alba*. They generally have a slow growth, and all are very prickly.

P. sitchensis is to be found in Danish gardens of from thirty to forty years old. Some planted in 1864, and recently measured, gave the following dimensions : Height, 49 feet ; girth, 3 feet 6 inches.

P. Yezomomi. This is a new species recently introduced into Europe from Yezo. I think it will prove hardy in Denmark.

35. TSUGA.—Endl. Conif. 83. *Picea*, sect. 2, Link in Linnæa, xv. 523. *Abies*, sect. 4, *Peuceoides*, and sect. 5, *Micropeuce*, Spach, Hist. des Vég. Phan. xi. 423, 424. *Tsuga*, Carr. Conif. 185, and ed. 2, 243. *Keteleeria*, Carr. in Rev. Hort. Ann. 1866, 449, and Conif. ed. 2, 260 ; Beissn. Nadelh. 393 ; H. Mayr, Monogr. Abietineen, 1890, 58.

Flowers monœcious ; the male flowers axillary, almost terminal as they are placed near the upper leaves. The female flowers are terminal. Cones pendent, almost spheroid, about 1 inch long ; in one species three times as long.

Cotyledons three to six.

Leaves small, linear, flat or slightly four-sided ; they are somewhat spirally scattered, but often arranged in two rows.

Evergreen trees, with shoots and twigs pendent and gracefully curved.

The species of this genus are all found in eastern and western North America, in Japan, and on the Himalayas.

T. Brunoniana, Carr. Conif. ed 2, 247. *Pinus dumosa*, Don, Fl. Nepal. 55. *P. decidua*, Wall. Mss. *P. Brunoniana*, Wall. Pl. Asiat. Rar. iii. 24, t. 247. *Abies Brunoniana*, Lindl. in Penny Cyclop. i. No. 9. *A. dumosa*, Loud. Arb. Brit. iv. 2325, f. 2233-34.

Habitat.—In the temperate Himalayas at an elevation of 8,500–11,500 feet, in Bhotan. It was first discovered by Captain Webb in the north-west of Nepaul, in the inner valleys of Sikkim ; here Hooker found trees of about 130 feet high, and about 30 feet in circumference. Wallich first called the tree *Pinus decidua*, because damaged or broken branches drop their leaves.

A fine tree, growing from 70 to 80 feet high, with spreading branches and pendulous brittle branchlets, found in Bhotan Proper, occurring from 6,500 to 9,500 feet of elevation ; a large, solitary tree. Dr. Griffith measured one specimen 27 feet in girth, at a height of five feet from the ground. Dr. Hooker found it in Sikkim, forming a narrow belt at an elevation of from 9,000 to 10,000 feet, on the south flank of Kunchinjunga, probably the loftiest peak in the world ; but in the innermost valleys the limits are from 8,500 to 10,500 feet of elevation.

In Nepaul it is called “Changathasi-Dhoop,” a name implying that it is employed for incense,

The Gorkhalees, in Nepal, call this tree "Thingia" (Yew), or "Thingoori-Sulla" (fragrant Yew), and the Bhotiyas, "Semadoong," which has a similar meaning; but, according to Professor Don, it is better known under the name of "Silloo-Haterhee" (fragrant Fir), and is found plentifully on the mountains of Gosainthan, in Nepal, where its bark is much used for the covering of sheds and outhouses.

It is by far the handsomest of all the Indian Firs in a native state; but its timber is of a very inferior quality, and soon perishes if fully exposed to the weather.

A young plant out of doors during the last two years has kept alive in Denmark under cover of some leaves and Spruce branches, but it suffered a little.

T. canadensis, Carr. Conif. ed. 2, 248. *Abies foliis solitariis confertis obtusis membranaceis*, Gronov. Virgin. 191. *Pinus canadensis*, Linn. Spec. Pl. 1421. *P. americana*, Du Roi, Obs. Bot. 41. *P. Abies americana*, Marsh. Arb. 103. *Abies canadensis*, Michx. Arb. Forest. de l'Amér. Sept. i. 137, t. 13. *Picea canadensis*, Link in Linnaea, xv. 524.

Habitat.—Nova Scotia, Southern New Brunswick, valley of the St. Lawrence River to the shores of Lake Temiscaming, and south-west to the western borders of Northern Wisconsin; south through the Northern States to Newcastle County, Delaware, South-eastern Michigan, Central Wisconsin, and along the Alleghany Mountains to Clear Creek Falls, Winston County, Alabama (Mohr).

A tree 70–110 feet in height, with a trunk 3–4 feet in diameter; dry rocky ridges, generally facing the north, and often forming extensive forests almost to the exclusion of other species, or, less commonly, borders of swamps in deep, rich soil; most common in the north, although reaching its greatest individual development in the high mountains of North Carolina and Tennessee.

Wood light, soft, not strong, brittle, coarse, crooked-grained, difficult to work, liable to wind-shake and splinter, not durable; bands of small summer cells rather broad, conspicuous; medullary rays numerous, thin; colour light brown tinged with red, or often nearly white, the sapwood somewhat darker; specific gravity, 0.4239; ash, 0.46; largely manufactured into coarse lumber and used in construction for outside finish, railway ties, &c.; two varieties, red and white, produced apparently under precisely similar conditions of growth, are recognised by lumbermen (C. S. Sargent, "Forest Trees of North America"). The bark, rich in tannin, is the principal material used in the Northern States in tanning leather, and yields a fluid extract sometimes used medicinally as a powerful astringent. Canadian or Hemlock pitch, prepared from the resinous secretion of this species, is used in the preparation of stimulating plasters, &c. ("U.S. Dispensatory," ed. 14, 709, 903; "Nat. Dispensatory," ed. 2, 1109; Flückiger and Hanbury, "Pharmacographia," 552).

The wood of the Hemlock Spruce, according to Michaux, is less valuable than that of any other of the large resinous trees of North America ; but the bark is of inestimable value for the purposes of the tanner. It is always esteemed an excellence in wood to split in a straight line, which it does when the fibre is vertical ; but that of the Hemlock Spruce is so oblique that it makes the circuit of trunks 1 foot 3 inches to 1 foot 8 inches in diameter in ascending five or six feet. Besides this defect, which is general, and which renders it unfit for rural fences, the old trees frequently have their concentric circles separated at intervals, or, in the language of the country, are shaky, which greatly impairs their strength. This effect is produced by the winds, which have a powerful hold upon the large compact summit formed by the head of the Hemlock Spruce, exposed, as it generally is, above the tops of the surrounding trees. The wood is found to decay rapidly when exposed to the atmosphere, and is therefore unsuited for the external covering of houses, which is another important defect in a country where nearly all the houses are of wood, but when covered it is of great durability ; and as the White Pine (*P. Strobus*) becomes rarer, the Hemlock Spruce is substituted for it as extensively as possible. It is firmer, though coarser grained ; affords a tighter hold to nails, and offers more resistance to the impression of other bodies. For this reason it is employed, in the district of Maine, in the form of two-inch planks for threshing-floors. But the most common use, in which great quantities are consumed in the Northern States, is for the first sheathing of wooden houses, which are afterwards covered over with clap-boards of White Pine. For economy, the interior frame is also often made of Hemlock Spruce, and it is found, when guarded from the damp, to be as desirable as any other species. It is always chosen for the laths of the interior walls, and it is exported in this form to England. In the district of Maine it is usually taken for the posts of rural fences, which last about fifteen years, and are preferable to those of the Grey and Red Oaks (*Quercus ambigua* and *Q. rubra*). It contains little resin, and the trunk is but slightly coated with turpentine, even where large pieces of bark have been a long time removed. The bark, when used for tanning, is taken from the tree in the month of June, and half the epidermis is shaved off with a plane before it is thrown into the mill. From the district of Maine it is exported to Boston, Providence, &c., and is almost exclusively employed in the tanyards at those places. It is brought to New York from the upper parts of the Hudson, and is sometimes carried to Baltimore. Its deep red colour is imparted to the leather ; and, though it is inferior to the bark of the Oak, the American tanners think the bark of the two kinds united are better than either of them alone. Hemlock Spruce bark was once exported to England, but the commerce has ceased with the demand. The Indians are said to use it in dyeing their light baskets made of Red

Maple (Michaux). The young twigs and ends of the shoots are used by the settlers as a substitute for tea; the essence of spruce is also extracted from the shoots. In England the Hemlock Spruce forms one of the most ornamental of the Fir family, being among needle-leaved evergreen trees what the Weeping Willow is among the Willows. As it bears the knife, and is extremely hardy, it might be employed as hedges, for which purpose it is used in the American nurseries, along with *Thuja occidentalis*.

This Hemlock of Eastern America is the best known of all the Spruces, being freely planted in the Eastern States, as well as in Europe and Australia. It is recognised at sight by its many long ascending plume-like branches, divided into small twigs, each clothed with dark green leaves in two ranks, and its small oval cones, about three-fourths of an inch long, produced along the edges of the plumes like a fringe of pendent acorns.

Always beautiful when standing alone, and where it can expand, this tree becomes singularly unsightly when crowded in a swamp. Here, in yielding to the pressure of its environment and the attacks of its neighbours of the same species—always the most ruthless of enemies, since all are inherently fitted for the place which only one may be able to seize and hold—the tree becomes extremely dejected and its branches crippled.

This aspect of decrepitude does not appear when the tree is allowed to develop at will, as on the edge of a forest, or when planted on a lawn, where it becomes a mass of conical foliage of great beauty. The branches, nearly horizontal, spring out irregularly from the trunk, never in whorls; the branchlets bend gracefully outward and downward, the longest in the middle of the branches, dividing and subdividing into tiny segments, reminding one of the compound leaves of the Poison Hemlock of the Parsnip family, and this resemblance suggested the popular name "Hemlock" for these trees (J. G. Lemmon, "California State Board of Forestry," 1889-90).

No evergreen tree or shrub can excel this Conifer for richness of foliage or beauty of outline; and during spring or early summer the young, drooping shoots, of a lively yellowish green, contrast finely with the dark sombre green of the older foliage, and form a combination that, for pleasing effect, is certainly hard to match. An erroneous opinion is gaining ground that the Hemlock Spruce is not suited for the climate of Britain; even Loudon and Michaux have little to say in its favour; and as a veteran American arboriculturist some time ago remarked, English nurserymen have generally followed suit by regarding the tree in a similar light. True it is we have no such specimens as are recorded from "the Far West," and equally true is it that this Spruce will not flourish and put on its best garb when planted anywhere and anyhow with us, no more than do the majority of foreign importations; but treat the Hemlock Spruce in a rational

inanner, and as its nature requires, and it will ere long be found that few trees are more amenable to cultivation, and, perhaps, none repay more fully the bestowal of a little extra care and attention at the time of planting. Numerous instances of the rapid growth of this Conifer in the British Isles might be adduced. A moist, deep, rich, but light soil and sheltered situation are its chief requirements.

Few trees in Britain have attained the age or size at which the wood is mature; but specimens that have come under my notice might be reckoned as second-class in the Pine list. The late Mr. Speed, gardener at Chatsworth, who had unusual opportunity of observing the tree and testing the quality of the wood, reported the latter as hard and heavy. In its native country the wood of the Hemlock Spruce is not much in request, being coarse and crooked-grained, and liable to splinter. It is sawn into boards of an inferior quality, adapted for mining purposes, flooring of barns, wharves, and out-buildings. The bark is used for tanning purposes, and in America realises about fifteen shillings per ton. Introduced about the year 1736 (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

Trees of *T. canadensis* of about a hundred years of age have in some Danish gardens attained a height of 50 feet and more. One planted in 1845 now measures 34 feet in height, with a girth of 2 feet.

T. c. gracilis, Waterer. *Abies canadensis microphylla*, hort.

This is a very singular-looking variety of the Hemlock Spruce, on account of its slender shoots, thin appearance, and small foliage. The leaves are linear, blunt-pointed, glossy above and glaucous below; more or less obliquely placed all round the shoots, and seldom more than three lines long. Branches and branchlets very slender, little divided, more or less drooping at the ends, and rather thickly covered with the small obliquely placed leaves.

A very distinct and singular-looking variety, raised at Knap Hill, in Surrey.

T. c. nana, Carr. *Picea canadensis nana*, Lawson.

A dwarf variety, not growing more than two or three feet high, and spreading on the ground, with a more tufted foliage.

T. caroliniana, Engelm. in Coulter's Bot. Gaz. vi. 23; Sargent, Forests of N. America (Final Reports, Tenth Census of U.S.), ix. 207. *Abies caroliniana*, Chapman in Fl. of S. States, suppl. 650.

Habitat.—Southern Alleghany region, Bluff Mountain, North Carolina (A. Gray); "Saluda Mountains," South Carolina (L. S. Gibbs); Pinnacle Mountain, North Carolina (Curtiss); New River, North Carolina, and Coeurshead, South Carolina (Canby); Whiteside's Mountain and Devil's Court-house Peak, Jackson County, North Carolina (J. Donnell Smith).

A small tree, 40-50 feet in height, with a trunk 2-2½ feet in diameter; dry, rocky ridges between 4,000 and 5,000 feet elevation; rare and local; long confounded with the closely allied *T. canadensis*.

In 1881 Dr. Engelmann published it under the name of *T. caroliniana*, described from specimens (collected by Professor Gibbs, of Charleston), as distinguished from *T. canadensis* by its larger, glossier, blunter leaves, and its larger cones with wide-spreading scales. These points, combined with its alpine habit, seem quite sufficient to indicate that the variation from a common type has been long continued, and is sufficient for specific recognition (J. G. Lemmon).

In Denmark we have only a young plant put out for trial last year.

T. diversifolia, Maxim. in Mém. Biolog. vi. 373; Franch. and Savat. Enum. Pl. Jap.

Habitat.—Maximowicz found this *Tsuga* isolated here and there on the mountains of Kiushiu; Mayr saw it on several mountains of Central Japan, such as the Nantasin, the Shiranesan (Kotsuke), in large forests, some of these not containing other trees. It was often found in the Beech region, and even a few examples were found near the alpine region.

Possibly hardy.

T. Hookeriana, Murray in Edin. New Phil. Journ. 289 (April 1855), and in Proc. Hort. Soc. ii. 202 (1863). *Abies Williamsonii*, Newberry in U.S. Pacif. R.R. Rep. vi. 53 (1857).

I find it right to keep the name *T. Hookeriana* to the young plants we have received under that denomination, as they look different from *T. Pattoniana*.

Hardy.

This tree was found by Mr. W. Murray on Scots Mountain, one of the high Californian mountains, about lat. 41° 20' N., long. 122° 37' W., where the ground was already covered with snow, on the 16th of October. Dr. Newberry found it on the summit of the Cascade Mountains in Oregon, lat. 44° N., and says that it is the most alpine in its habit of all the Firs, extending from the height of 6,000 feet up to the limit of perpetual snow. He adds: "It will doubtless be found in similar circumstances on other parts of the Cascade range, but we saw it only on the group of mountains called the Three Sisters." We are no granters of propositions; and therefore, before assenting to it, should like to know, a little better than appears from the Doctor's description, what he means by its being the most alpine in its habit of all the Firs. Will it bear a more arctic climate than *Pinus Banksiana*, or *Abies nigra*, or *A. excelsa*, which in Norway extends as far north as lat. 70°? We think not; but that is of less consequence than the important fact that it is a beautiful tree, and so far alpine as to make it perfectly safe to cultivate in the coldest parts of Britain or temperate Europe. Lobb found it in great abundance on the highest peaks of the Sierra Nevada, near the head-waters of the north tributary of Feather River, also more southerly towards

Lake Bigler, in lat. 39° 30' N. and long. 120° 15' W. ("Pinetum Britannicum").

T. Mertensiana, Carr. Conif. ed. 2, 250. *Pinus Mertensiana*, Bong. Vég. de Sitka, 45. *P. canadensis*, Hook. Fl. Bor. Amer. ii. 164. *Abies Mertensiana*, Lindl. and Gord. Journ. Hort. Soc. v. 211. *A. taxifolia*, Jeffr. ex Murr. *A. Bridgesii*, Kellog. in Proc. Calif. Acad. of Nat. Sc. ii. 37. *A. Albertiana*, Murr. Syn. var. Conif. 9. *Tsuga canadensis* var. *Mertensiana*, Newb. ex Zabel in Forstl. Blätt. ix. Jahrg. s. 209, 210.

Habitat.—Alaska, south along the islands and coast of British Columbia, and through the Selkirk, Gold, and other interior ranges to the Bitter Root Mountains of Idaho, and the western slopes of the Rocky Mountains of Montana (valley of the Flathead River, Canby and Sargent), extending south along the Cascade Mountains to Southern Oregon, and in the coast ranges to Marin County, California, between 1,000 and 4,000 feet elevation.

A large tree, 100–200 feet in height, with a trunk 4–10 feet in diameter; low, moist bottoms or rocky ridges; very common, and reaching its greatest development, in Western Oregon and Washington Territory, often forming extensive forests, especially along the western base of the Cascade Mountains.

Wood light, hard, not strong, rather close-grained; bands of small summer cells thin, not conspicuous; medullary rays numerous, prominent; colour light brown tinged with yellow, the sapwood nearly white; specific gravity, 0.5182; ash, 0.42; occasionally manufactured into coarse lumber. The bark, rich in tannin, is the principal material used on the north-west coast in tanning leather (C. S. Sargent, "Forest Trees of North America").

This graceful Conifer, with its drooping branches and delicate feathery sprays of foliage silvered on the under side, is one of the most ornamental that has yet found its way into this country. The foliage is much admired, particularly in early summer, when each twig is terminated with a tuft of golden-green leaves surmounted by the darker green of the previous year. The whole contour of Prince Albert's Fir, particularly when grown in suitable soil—a peaty loam—is gracefully irregular, the long and lithe branches and pendulous branchlets imparting a refined air that never fails to attract attention.

For lawn and park planting it is in much request, and may be described as the most beautiful of its class. As a timber tree, however, it is not likely to attract much attention, at least in Great Britain, although, as exhibited at the Forestry Exhibition in Edinburgh, the wood seemed of excellent quality, and thanks are due to the forester to the Right Hon. T. Inglis, of Glencorse, Midlothian, for the practical way in which the timber was tested for fencing posts. One of those exhibited had been in the ground five years, and appeared to be little the worse. The upward annual growth of this Spruce is

fairly rapid, the average of fifteen specimens growing under favourable circumstances being 20 inches. At Hafodunus, in North Wales, one of these trees in thirty-five years produced $48\frac{1}{2}$ feet of wood, or fully $1\frac{1}{2}$ foot per annum. Introduced in 1851 (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

This species is still rare in Danish gardens. One of about the age of forty years has attained a height of 30 feet.

T. Pattoniana, Engelm. in Bot. Calif. and Wats. Fl. Calif. ii. 121. *Abies Pattoni* or *Pattoniana*, Jeffr. in Rep. Bot. Exp. to Oregon, 1 (*cum ic.*). *A. Hookeriana*, Murr. in Edinb. New Phil. Journ. 1855, new ser. 289, t. 9. *A. Williamsoni*, Newb. Pacific R.R. Rep. ii. 53, t. 7. (?) *Picea californica*, Carr. Tr. Conif. 261, and ed. 2, 346. *Pinus Pattoniana*, Parl. in DC. Prodr. xvi. 2, 429. *Tsuga Hookeriana*, Carr. Conif. ed. 2, 252.

An alpine tree, rarely 100 feet in height, with a trunk 5-7 feet in diameter; dry slopes and ridges near the limits of tree growth, ranging from an elevation of 2,700 feet in British Columbia to 10,000 feet in the Sierras of Central California.

Habitat.—Valley of the Fraser River, British Columbia, and probably much further north; south along the Cascade Mountains and the Californian Sierras to the head-waters of the San Joaquin River, extending east along the high mountains of Northern Washington Territory to the western slopes and summits of the Cœur d'Alène and Bitter Root Mountains of Idaho (Lolo trail, Watson), and the divide between Tompson and Little Bitter Root Creeks, Northern Montana (H. B. Ayres).

T. P. argentea. Both the species and the variety seem to thrive very well.

T. Sieboldii, Carr. Conif. ed. 1, 186. *Abies Tsuga*, Sieb. and Zucc. Fl. Jap. ii. 14, t. 106. *Pinus Tsuga*, Ant. Conif. 23, t. 32, f. 2; Endl. Conif. 83. *P. Araragi*, Sieb. Verh. van het Batav. Genotsch. xii. 12. *Abies Araragi*, Loud. Encycl. of Trees, 1036. *Tsuga Tsuga*, Murr. Sketch of Conif. of Jap. in Proc. Hort. Soc. ii. 508.

Habitat.—In Kiushiu and Shikoku this *Tsuga* almost wholly occupies many narrow, stony, but warm valleys. At a higher elevation it grows together with *Pinus parviflora*.

36. PSEUDOTSUGA.—Carr. Conif. ed. 2, 245, and in Rev. Hort. 1868, 152 (*cum ic.*); Parl. in DC. Prodr. xvi. 2, 430 (*Pini* sect. *Tsuga*); Spach, Hist. Vég. Phan. xi. 423 (*Peuceoides*); Endl. Syn. Conif. 87; Engelm. Bot. Calif. ii. 119; Forb. Pin. Wob. t. 45; Nutt. N. Amer. Sylv. t. 115 (*Abies*); Hook. Fl. Bor. Amer. t. 183 (*Pinus*); Newberry, Bot. Williams Exped. t. 8; C. Koch, Dendr. ii. 255 (*Abies*); Henk. and Hochst. Nadelh. 155 (*Abies*); Eichler in Engl. and Prantl, Natürl. Pfl. ii. s. 80 (*Tsuga* incl. *Pseudotsuga*); Willk. Forstl. Fl. s. 103; Beissn. Handb. der Nadelholzk. 410.

Branches verticillate or whorled. Bark on the young shoots glabrous.

Leaves flattish, coriaceous, stiff, bright green, more or less acuminate, pointed.

Cones about $3\frac{1}{2}$ inches long, pendent, persistent, somewhat long.

Bracts very long and two-pointed.

Cotyledons six to twelve.

Very large evergreen tree. Leaves at the base stalked and narrow, linear, flat, spirally scattered, and as they are turned at the base, they stand almost in two rows.

P. Douglasii, Carr. Conif. ed. 2, 256. *Pinus taxifolia*, Lamb. Pin. ed. 2, 58, t. 36. *P. Douglasii*, Sab. Mss. in Lamb. Pinet. ed. 2, iii. t. 72. *Abies Douglasii*, Lindl. in Penny Cyclop. i. 32. *Picea Douglasii*, Link in Linnæa, xv. 524. *Tsuga Douglasii*, Carr. Conif. ed. 1, 192. *Abies californica*, hort. aliq.

Habitat.—Coast ranges and interior plateau of British Columbia south of latitude 55° N. (not reaching the coast archipelago north of Vancouver's Island); east to the eastern slope of the Rocky Mountains in latitude 51° N. (Bow River Pass, Macoun); south along the mountain ranges of Washington Territory, Oregon, the California coast ranges, and the western slope of the Sierra Nevadas; through the mountain ranges east to Montana, Wyoming, Colorado, and the Guadaloupe Mountains of Texas; in the Wahsatch and Uintah Mountains, the ranges of Northern and Eastern Arizona, and southward into Mexico; not detected in the interior region between the Sierra Nevada and the Wahsatch Mountains, south of the Blue Mountains of Oregon and north of Arizona.

A large tree, 200–300 feet in height, with a trunk 3–12 feet in diameter, or in the Rocky Mountains much smaller; here rarely 100 feet in height; the most generally distributed and valuable timber-tree of the Pacific region, growing from the sea-level to an elevation in Colorado of nearly 10,000 feet; often forming extensive forests almost to the exclusion of other species, and reaching in Western Oregon and Washington Territory its greatest development and value.

Wood hard, strong, varying greatly with age and conditions of growth in density, quality, and amount of sap; difficult to work, durable; bands of small summer cells broad, occupying fully half the width of the annual growth, dark-coloured, conspicuous, soon becoming flinty and difficult to cut; medullary rays numerous, obscure; colour varying from light red to yellow, the sapwood nearly white; specific gravity, 0.5157; ash, 0.08; largely manufactured into lumber and used for all kinds of construction, railway ties, piles, fuel, &c. Two varieties, Red and Yellow Fir, are distinguished by lumbermen, dependent probably upon the age of the tree; the former coarse-grained, darker coloured, and

considered less valuable than Yellow Fir (C. S. Sargent, "Forest Trees of North America"). The bark is found valuable in tanning leather.

This species was first found by Menzies in Nootka Sound, when Vancouver stopped there on his celebrated voyage round the world (1790-95), in which Menzies accompanied him as naturalist and surgeon. It was figured and imperfectly described by Lambert, under the name *Abies taxifolia*, from specimens of the foliage brought by Menzies; and these specimens are still preserved in the British Museum, the museum having acquired Lambert's collection after his death. No seeds were, however, brought by Menzies. Others, probably, had also found it, for Nuttall had specimens before Douglas. Specimens from him also are in the British Museum, and his manuscript name for it was the characteristic one of *Abies appendiculata*.

It was re-discovered by Douglas in 1827, when collecting for the Royal Horticultural Society, and anew described and figured with the cone by Sir William Hooker, under the name by which it has since been generally known (*Abies Douglasii*). A plentiful supply of seed was then sent by him to the Society, and distributed among its Fellows; and a number of trees, the oldest in Britain, scattered here and there throughout the country, are the produce of that first consignment.

Perhaps more has been written about this Fir than any other of recent introduction. Although of a spreading habit where it has room to grow, it is among the fastest timber-producing trees of the Fir tribe; but when grown too fast the wood is of a rough and second-rate quality. Possibly, with the exception of the Larch, this Fir is the most valuable, commercially, of all the exotic Conifers. Hitherto it has been grown in too limited numbers, and under exceptional treatment, to enable us to put a proper value upon its timber. If treated like our common forest-trees, my belief is that it will not supersede some other species of Fir. *Abies Menziesii* grows at as high altitudes in its native habitat, and in some places in Scotland it is producing as much, if not more, timber than the Douglas Fir; and before we place the latter higher, we must see its value better tested as a common forest-tree. As yet the Larch is the tree *par excellence* for forest-planting; and I question very much, if the Douglas Fir were once tested as thoroughly as the Larch has been, whether its supposed superiorities would not vanish. This dark-green tree, grown as a single specimen, is of an open habit of growth, and rather ornamental.

In certain situations it is one of the most valuable timber-trees that have yet found their way into the British Islands. As regards the actual produce of timber in a given time, it is far ahead of any other tree grown in this country, not excepting the Wellingtonia or Sequoia. We state this from measurements recorded by ourselves for a number of years of trees grown under similar conditions as regards soil, altitude, and situation. The greatest amount of timber produced by the

Douglas Fir in this country during fifty years is no doubt that of which we kept a record, viz. 240 feet, or nearly 5 feet per year for half a century. The tree here referred to as having produced this almost fabulous quantity of wood is growing on an estate in North Wales, and is of the following dimensions : Girth of stem at three feet up, 11 feet 9 inches ; and at twenty-one feet up, 8 feet 4 inches ; 42 feet in length of the butt contains 217 feet of excellent clean timber. Another Douglas Fir, growing within a few yards of the former, has a girth of stem at three feet from the ground of 13 feet 8½ inches ; and 24 feet in length of the stem contains exactly 131 feet of wood. In a plantation of this Fir formed twenty-two years ago, the average sizes we found to be as follows : Height, 76 feet ; girth of stem at twenty-four feet up, 4 feet ; cubic contents, fully 50 feet.

The timber produced in this country is of excellent quality, being light but strong, works readily, has a pleasant yellowish tinge, and takes a good polish. By way of experiment we have used the wood rather extensively for fencing purposes, for doors, in boat-building (principally as masts), and for various other purposes, and with excellent results ; although it would be premature to speak with perfect certainty, for sufficient time for a fair trial has not elapsed since the experiments were instituted. As an ornamental tree for the park or lawn the Douglas Fir is of great value, its graceful outline and wealth of foliage being special attractions. When planted in clumps or masses it is effective, the beautiful rich green foliage being pleasing in the extreme, particularly in early spring, when the young leaves are becoming fully developed, for then the contrast between these and the dark green—almost Yew-green—of the older foliage is strikingly distinct.

The cultivation of the tree in Great Britain and Ireland looks at present very encouraging, and I trust that experiments will be continued ; but I deprecate altogether rushing into extensive plantings, as advocated by the correspondent of the *Perthshire Constitutional*, until time has shown that the tree really deserves to supersede the species hitherto cultivated by us, and of which we know what to expect. My personal opinion is, that the Douglas Fir will just as little revolutionise our silvicultural operations as the Weymouth Pine has been able to do, though great things were expected of it at one time. There is a great difference between nursing up a single tree in a fine soil and under otherwise favourable conditions, and the growing of a species on a large scale for economic purposes ; in the former case only exceptional results present themselves to the eye, while in the latter case averages must be looked for and reckoned with.

In planting the Douglas Fir for ornament, ample space should be allowed for the development of all the branches, as, if the trees are crowded together, the lower branches die off, and thus greatly mar

the effect. It is difficult to decide the distance apart at which these trees should be planted, much depending on the soil, position, and altitude at which they are grown. A safe average, under ordinary conditions as to soil and situation, would be 20 feet, the standards ultimately left being 40 feet apart; thus giving, in the majority of instances, ample room for the spread of branches (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

Quite recently (April 1890), a German writer, Dr. Heinrich Mayr, has published several articles in the *Garden and Forest* upon our Cone-bearers, notably one upon this tree, which in Germany is called "Douglasia." He writes at length about its desirable qualities and its cultivability. He declares that the Douglasia will become the Larch of the plains and lowlands of Germany. This is saying much in its praise where the Larch is so highly valued as it is in Germany.

The tree in cultivation maintains its disposition to vary greatly, and the Doctor writes: "Where it is heaviest, it comes nearest to Larch; but when lightest it is the equal of any Fir, Spruce, or Pine."

Second only to the Germans are the French, Belgians, Austrians, Swiss, Italians, and English in their appreciation and utilisation of the Douglas Spruce, while large quantities of the seeds are exported yearly to Australia and New Zealand (J. G. Lemmon).

Pseudotsuga Douglasii is to be found in Danish parks and gardens, at an age of from thirty to forty years, and some trees measure 50 feet and more in height.*

In South Norway they are to be found nearly 50 feet high. In Sweden the Douglas Fir has done well at Stockholm. It seems as if it will also succeed at St. Petersburg.

P. D. Stairii, hort. *Tsuga Douglasii Stairii*, hort. *Abies Douglasii Stairii*, hort.

This distinct, pretty variety, which originated at Castle Kennedy, the Earl of Stair's seat in Wigtownshire, Scotland, is almost white in spring. It assumes a colour approaching the type in summer, and a silvery tint in autumn, and generally loses its leaves before the next season's growth appears, sometimes even before winter commences. It is of a dwarfish habit, and is a unique specimen for the lawn. It was described in the *Gardeners' Chronicle*, Nov. 18, 1871, and in the *Garden*, Nov. 23, 1872, as a veritable silver or almost pure white Spruce.

P. D. Standishiana, Gord. This very remarkable variety was first observed by Mr. Standish in his nursery at Bagshot, growing amongst some seedling *P. Douglasii* raised from English-saved seed,

* A flagstaff of *Pseudotsuga Douglasii* is erected near the Temperate House in the Royal Gardens, Kew. It came from Vancouver's Island, and was presented to the Royal Gardens in 1861 by Edward Stamp, Esq. It is 159 feet high (about 12 feet being underground), and weighs 4 tons 8 cwt. 2 qrs. Age about 250 years. Circumference at ground-level about 4½ feet.

gathered from a Douglas Fir growing in close proximity to some large Silver Firs.

P. D. taxifolia, Carr. Conif. ed. 2, 258. *Tsuga Douglasii taxifolia*, Carr. Conif. ed. 1, 193. *Abies Douglasii taxifolia*, Loud. Encycl. of Trees, 1033, f. 1932-33. *Abies taxifolia Drummondii*, ex Gord. Pin. Suppl. 10. (?) *Tsuga Lindleyana*, Roetzl, Cat. Conif. Mexic. 1857, 8. *Abies Drummondii*, hort. *Abies Douglasii americana*, Hartweg. *Abies Douglasii brevibracteata*, Ant.

A very distinct variety with much longer leaves, and of a deeper green, than the species, with the cones much shorter, but broader and less pointed; the extended bracts are also much shorter, and not much longer than the scales.

A small, handsome tree, growing from 30 to 40 feet high, with horizontal branches and straight branchlets, little forked, found on the Real del Monte Mountains in Mexico, at an elevation of from 8,000 to 9,000 feet, and in the Oregon country.

37. **KETELEERIA**, Carr.--Carr. Rev. Hort. 1866, 449 (*cum ic.*), and Conif. ed. 2, 260; Parl. in DC. Prodr. xvi. 2, 430 (*Tsuga Pini* sect.); C. Koch, Dendr. ii. 231 (*Picea*, Don). *Abies*, Lindl. in Paxt. Flow. Gard. 1850, 43; A. Murr. fil. Pines and Firs of Jap. 49; Henk. and Hochst. Nadelh. 183; Hance in Journ. of Bot. 1882, xx. 32; Gord. Pinet. ed. 2, 27; Masters in Journ. Linn. Soc. xviii. 522, and in Gard. Chron. 1868, 1338; Oct. 8, 1887, 440; Feb. 16, 1884, 214; Pirota in Bull. d. R. Soc. Tosc. de Oricult. 1887, 269; Beissn. Handb. d. Nadelholzk. 420.

This monœcious genus has been named by Carrière after Mons. Keteleer, at that time one of the firm of Thibaut and Keteleer, at Sceaux.

Large evergreen trees with, when old, umbrella-formed crowns.

The leaves are almost two-ranked, and more or less scattered, stiff, linear, flat, a little curved near the base, long and sometimes pointed, green on the upper side, and a lighter green on the under side.

The cones are upright and cylindrical. In some descriptions we are told that the scales keep together, but I have observed that in my collection they usually droop like the cones of the *Abies*.

Much difference of opinion exists as to whether *Keteleeria Fortunei* is a Spruce, a Silver Fir, or a new genus, which arises from its having erect, cylindrical cones with persistent scales, soft angular seeds full of turpentine, permanent wings, and flat, linear-lanceolate leaves somewhat spirally arranged on the young shoots, and more or less two-rowed on the adult parts; from all of which it would seem to be intermediate between the two; but having persistent scales on the cones, it must be considered as belonging to the Spruces rather than to the Silver Firs (G. Gordon, "The Pinetum," 1875).

K. Fortunei, Carr. Rev. Hort. 1866 (*cum ic.*), and Conif. ed. 2,

260. *Abies Fortunei*, Murr. Pines and Firs of Jap. 1863, 49. *Abies jezoënsis*, Lindl. in Paxt. Flow. Gard. 1850, 43. *Picea Fortunei*, Murr. Proc. Hort. Soc. 1862, 421. *Pseudotsuga jezoënsis*, Bertrand in Ann. Sc. Nat. ser. 5, xx. 87 (Bot.). *Pinus Fortunei*, Parl. in DC. Prodr. xvi. 2, 430. *Picea jezoënsis*, Carr. Conif. ed. 1, 255 (in part, excl. syn.).

Habitat.—South-eastern China, with Foo-chow-foo. Abundant on the mountains to the north of Foo-chow, intermixed with *Pinus Massoniana*.

Introduced by Mr. Robert Fortune in 1846.

Hardiness doubtful.

It is a singular fact that up to this time but one tree of this kind is known in its (presumed) native country—that originally met with by Fortune in the vicinity of a temple at Foo-chow-foo, in China.

Fortune speaks of it as a magnificent tree with the habit of a Cedar of Lebanon, with beautiful erect purple cones. No other tree of this species, is, as we have said, known, except those raised from Fortune's seeds. From this circumstance, and the fact of its situation in the grounds of a temple, it is probable that the tree was introduced to Foo-chow-foo, and that its native habitat will sooner or later be discovered. Meanwhile it is satisfactory to know that Messrs. Rovelli, of Palanza, North Italy, have raised sufficient plants from seed to obviate the risk of extermination of so remarkable a tree. The bark of the trunk is of a particularly thick corky character, quite unlike that of any other Conifer that we can recall, and much more like that of a Cork Oak (M. T. M. in *Gardeners' Chronicle*, March 1884, p. 348).

38. **ABIES**, Link.—Endl. Conif. 89. Genus *Abies*, Link in Linnæa, xv. 526; Carr. Conif. 195. *Picea*, Don in Loud. Arb. Brit. iv. 2329. *Abies*, sect. Pence and *Picea*, Spach, Hist. des Vég. Phan. xi. 414; Parl. in DC. Prodr. xvi. 2, 418; Engelm. Bot. Calif. ii. 117; Forb. Pin. Wob. t. 37-44; Fl. des Serres, t. 1437; Ledeb. Ic. Fl. Ross. t. 500; Nutt. N. Amer. Sylv. iii. t. 117-119; Newb. Bot. Will. Exp. t. 6; C. Koch, Dendr. ii. 208 (*Picea*, Don); Eichler in Engl. and Prantl, Natürl. Pflf. ii. 81; Willk. Forstl. Fl. 106.

Flowers monœcious; the male catkins axillary or terminal; the female ones solitary, on very short branchlets, and cylindrical.

Cones erect, cylindrical, or nearly so, axillary, and growing on the upper side of the branches.

Scales deciduous, or falling off when ripe from the axil of the cone, which remains persistent on the branches.

Bracts dorsal, and either enclosed by or projecting beyond the scales.

Seeds somewhat triangular, full of turpentine, two under each scale, covered with a soft tegument, and furnished with ample persistent, membranaceous wings, more or less wedge-shaped.

Cotyledons in fives.

Leaves solitary, flat, pectinated more or less in two rows, persistent, and silvery below.

All trees, found in Europe, Asia, North America, Mexico, and Northern Africa.

The name "*Abies*" is said by some writers to be derived from "*Apios*," a Pear-tree, the cones being like its fruit; while others derive the name from "*abeo*," to rise or spring up, in allusion to its aspiring habit of growth.

Pliny and the ancient writers originally called the Silver Fir "*Abies*" (which name may have been a corruption of "*albus*," the leaves of the Silver Fir being white when seen from below), but Linnæus afterwards changed the name to that of "*Picea*," on account of the abundance of resinous matter produced by the tree. More recently still, Professor Link proposed the restoration of its older name, under that of *Abies vera*, a suggestion which has been followed by nearly all the Continental writers, but rejected by some in England and America; hence the reverse of names applied to the Silver Fir and Spruces on the Continent to those used in England and in America.

Some pre-Linnæan botanists clearly distinguished the genera *Picea* and *Abies*, placing the Spruce in the former and the Fir in the latter genus. Linnæus reversed the terms, and the confusion in botanical nomenclature has continued to the present time.

Chief of those who apply the name "*Abies*" to the Fir family are almost all the older botanists, including Pliny and Tournefort, with the modern Link, Spach, Michaux, Nuttall, Carrière, &c.

As late as 1847, Endlicher, in his "*Synopsis*," still classed both the Spruces and the Firs with the Pines; and as late as 1856 Asa Gray, in his "*Flora of the Northern United States*," arranged the Spruces as a sub-genus of *Abies*, under the name of *Picea*.

Dr. Engelmann says: "I follow Link in his definition and limitation of the genus *Abies*, which seems to be a very natural one, comprising the Silver and Balsam Firs. The name "*Picea*" enjoys the Linnæan prestige, but is contrary to Pliny's and to classical usage. *Picea* is the Pitch-tree, and properly designates the Spruces. Tournefort, the elder De Candolle, Gray, and others comprised under the name "*Abies*" both the Spruces and the Firs; but the generic distinctions between them are abundant, and based upon floral and fruit characters, as well as upon leaf anatomy."

A. amabilis, Forbes, Pinet. Wob. 125, t. 44; Engelm. in Gard. Chron. 1880, 720, f. 136-41; Sargent, Rep. on the Forests of N. Amer. 1884, 213. *Pinus amabilis*, Dougl. Comp. Bot. Mag. ii. 93 (1825). *Picea amabilis*, Loud. Arb. iv. 2342, f. 2247-48. *Pinus grandis*, Lamb. Descrip. of the Gen. Pin. ed. 2, iii. t. 26 (not Dougl.). *Abies grandis* var. *densiflora*, Engelm. in litt.

Habitat.—Valley of the Fraser River, British Columbia (Engelmann and Sargent), and probably farther north; south along the Cascade Mountains of Washington Territory and Oregon.

A tree 100–150 feet in height, with a trunk sometimes 4 feet in diameter, forming extensive forests on the mountains of British Columbia, between 3,500 and 5,000 feet, and upon the mountains south of the Columbia River between 3,000 and 4,000 feet elevation, here reaching its greatest development; its northern range not yet determined.

Wood light, hard, not strong, close-grained, compact; bands of small summer cells broad, resinous, dark-coloured, conspicuous; medullary rays numerous, thin; colour light brown, the sapwood nearly white; specific gravity, 0.4228; ash, 0.23 (C. S. Sargent).

This species of Fir, though discovered sixty-five years ago, was not certainly known to exist until recently, the reports of early explorers having lost their credence with botanists, who came to the conclusion that the traditional *amabilis* was a form of some other species, or else a mythical Fir formed by mixing specimens of two or more species.

David Douglas, the veteran botanical explorer of the North-west, on his first trip up the Columbia River (1825), discovered this very local species (September 7) “on the top of a high mountain, south of the Grand Rapids of the Columbia River, after a laborious climb of fifteen hours.”

With it he had the good fortune to find another new Fir. The first he named *Pinus* (the generic name then of all the pitch trees) *amabilis*, on account of its lovely appearance; the other he called *P. nobilis*, for apparent reason, being a most noble tree in aspect.

The two species, he declared in his report, “are the grandest trees of the tribe.”

Returning to Fort Vancouver, he there met Dr. Scouler, another successful explorer of the Great West, and the two spent the night in relating experiences, “until the sun, rising over the noble stream, apprised them that another day had begun.”

Douglas lost the greater part of his specimens in various mishaps of long explorations during the winter season in a rough country, but succeeded in preserving a few, which he carried home to England and deposited with his English friends. Soon after he published these two species of Firs, with a third species collected earlier at the mouth of the Columbia (*Abies grandis*, “the Grand Fir”), in the “Companion to the Botanical Magazine,” 1836, as *Pinus amabilis* and *P. nobilis*.

In the year 1838 Dr. Lindley published the *A. nobilis* and *A. grandis*, under the present generic name *Abies*, in the “Penny Cyclopædia,” and by this early publication of the species under the present generic reference, Dr. Lindley becomes the namer of these two species.

Subsequently (1839), Forbes, in the "*Pinetum Woburnense*," published all three species, with illustrations, under the generic name of *Abies*, and because he was the first to so publish the *Amabilis* Fir he becomes the namer of that lovely species, while the enterprising, toiling, learned Douglas unfortunately loses this added honour.

It is unfortunate, and it seems unjust, that the discoverer of an object in natural history—one who, like Douglas, has the energy and daring to explore, the intelligence to comprehend when he has an object in sight that is new to science, and, moreover, the ability to describe and name it correctly, referring it to the proper genus in vogue at the time of publishing—it seems unjust that such a namer should subsequently lose the honours of discovery and of authorship, because, forsooth, another view of the relative importance of groups places the object in another category, and therefore another person, to wit, the one who so places it, becomes the author of the species. Such is the latest usage, however, based upon lately revived ancient laws of nomenclature; and, in the long run, it works less mischief than would a reverse rule, whereby pseudo-scientists could air their vanity by foisting upon us a host of unfounded terms at will.

Time passed, and many botanists visited the North-west; Jeffrey, in 1856, again reporting the *Amabilis* Fir from the Fraser River region, but others did not see it. For several years authors catalogued the species, relying upon the statements of Douglas and Jeffrey; but, at length, faith in their statements died out, and botanists began ignoring the species.

In 1879, Dr. Engelmann, who was elaborating the *Abietinæ* for the "*Botany of California*," boldly declared that there must have been some mixing of Douglas's and Jeffrey's specimens, and the "*Lovely Fir*" was therefore a myth—a fictitious species.

The next year, however (in 1880), the Doctor, accompanied by Professor Sargent and Dr. Parry, made an extended exploration of the forests of the great North-west, intent upon settling, once for all, several doubtful subjects that had all along marred our descriptive work, and they were very successful—after toiling as Douglas had done, finding that in every case the original explorers had told but the truth.

On Silver Mountain, near Fort Hope, Fraser River, at an elevation of 4,000 to 5,000 feet, they came in sight of a beautiful, unfamiliar Fir, which they at once recognised as the long-lost "*Amabilis*"—the same that Douglas had first made known fifty-five years previously.

A few weeks afterwards Professor Sargent ascended the very mountain where Douglas made his fifteen-hour climb, just south of the cascades of the Columbia River, and there also was found the *Amabilis* Fir in all its pristine beauty, and not far distant the Noble Fir, as Douglas had portrayed it.

In 1885, and again in 1889, Mr. and Mrs. Lemmon explored the

same forest region between the Columbia River and the base of Mount Shasta, where grow these two wonderful Firs—*amabilis* and *nobilis*; also near and below them is *Abies grandis*, and above, high on the timber line of Mount Hood, is a fourth species—the *Abies lasiocarpa*—this restricted region, of a few miles in extent, containing more species of Fir than any other known area (J. G. Lemmon).

A. balsamea, Mill. Dict. n. 3. *Pinus balsamea*, Linn. Spec. Pl. 1421. *Abies balsamifera*, Michx. Fl. Bor. Amer. ii. 207. *Picea balsamea*, Loud. Arb. iv. 2339, f. 2240-41.

Habitat.—Northern Newfoundland and Labrador to the southern shores of Hudson Bay; north-west to the Great Bear Lake and the eastern base of the Rocky Mountains; south through the Northern States to Pennsylvania, Central Michigan, and Minnesota, and along the Alleghany Mountains to the high peaks of Virginia.

A tree 70-80 feet in height, with a trunk rarely exceeding 2 feet in diameter, or at high elevations reduced to a low, prostrate shrub (*A. hudsonica*, hort.); damp woods and mountain swamps (C. S. Sargent).

Canadian balsam, or balm of fir, an aromatic liquid oleo-resin obtained from this and other species of *Abies* by puncturing the vesicles formed under the bark of the stem and branches, is used medicinally, chiefly in the treatment of chronic catarrhal affections, and in the arts ("U.S. Dispensatory," ed. 14, 898, 900; "Nat. Dispensatory," ed. 2, 1417; Flückiger and Hanbury, "Pharmacographia," 552).

Specimens of *A. balsamea*, about fifty years old and 40 feet high, are to be met with in Danish gardens.

In Norway, along the south coast, and on the west coast as far as Trondhjem (63° 20'), it may frequently be found; and in the neighbourhood of Christiania a tree of this species, about a hundred years old, has attained a height of nearly 60 feet and a girth of more than 6 feet (Schübel, "Viridarium Norvegicum").

A. brachyphylla, Maxim. Mém. Biolog. vi. 23. *Pinus brachyphylla*, Parl. in DC. Prodr. xvi. 2, 424; Ant. Conif. 78 (1846); Endl. Syn. Conif. 101 (1847). *Picea brachyphylla*, Gord. Pinet. ed. 2, 201. *Abies Veitchi*, hort. *A. Webbiana*, hort. *Picea Veitchi*, hort. *P. firma*, hort. *P. pinnosa*, hort. (the last five are all erroneous synonyms given in gardens). *Abies homolepis*, Lindl. and Gord. Journ. Hort. Soc. 1850, 210; Carr. Tr. Gén. Conif. 215 (1853); Miquel, Prolus. Flor. Jap. (1867).

This name will for the present be kept to one plant, which resembles that known as *Abies homolepis*.

According to Dr. H. Mayr, this Silver Fir is to be found in great abundance, between 36° and 38°, on the high mountains of Japan. About 1870 it was imported direct from Saghalien to Copenhagen, where one tree has since thriven well, although it has

not grown very tall. Another tree imported from England about fifteen years ago has produced cones in Denmark.

A. bracteata, Hook. and Arn. in Beechey, 394. *Pinus venusta*, Dougl. in Comp. Bot. Mag. ii. 152. *Pinus bracteata*, Don in Linn. Trans. xvii. 443. *Picea bracteata*, Loud. Arb. Brit. iv. 2348, f. 2256. *A. venusta*, C. Koch in Dendr. ii. 210.

Habitat.—Santa Lucia Mountains, California, from the northern boundary of San Luis, Obispo County, about forty miles northward.

A tree 150–200 feet in height, with a trunk 3–4 feet in diameter; moist, cold soil, occupying four or five cañons between 3,000 and 6,000 feet elevation, generally west of the summit of the range (G. R. Vasey).

Wood heavy, not hard, coarse-grained, compact; bands of small summer cells broad, resinous, conspicuous; medullary rays numerous, obscure; colour light brown tinged with yellow, the sapwood not seen; specific gravity, 0·6783; ash, 2·04; probably more valuable than the wood of the other North American Abies (C. S. Sargent).

This matchless Fir is another of those trophies that rewarded the laborious explorations and keen scrutiny of the veteran explorer of the North-west, David Douglas, who discovered this tree in March 1831.

A few paragraphs concerning this event, and the various names the tree has borne, cannot fail to be of interest:—

Mr. Douglas had made a journey to North-west America in 1825–26, and had explored the Columbia River region industriously, making many important discoveries, especially of Cone-bearers. No sooner had he arrived home and disposed of what specimens he had saved out of his numerous disasters, than he longed to return. Commissioned by the Royal Horticultural Society, he made a second journey in 1830, reaching the mouth of the Columbia River in October. In December he sailed southward, intent on exploring California, which, though a hot country, he was convinced possessed hosts of new trees on its mountains. He passed by the Golden Gate—no one at that date attaching any importance to the large bay within and the little hamlet of “Yerba Buena” on the peninsula—and arrived at Monterey, the capital of the territory, December 22, 1830. So jealous were the Mexican authorities, that Douglas had to spend three months in negotiating for a permit to explore the territory. The little he could move about, unobserved, was richly rewarded however.

“Early as was my visit to the coast,” he writes, “spring had already commenced. The first plant I took in my hand was *Ribes speciosum* (a native gooseberry), in full bloom. The same day I added to my new species *Nemophila insignis*, a humble but lovely plant, the harbinger of Californian spring, and forming a carpet, as it were, of the tenderest azure hue.”

When his permit to explore had arrived, he set out eagerly, and soon had traversed the region round about, reporting his observations

in letters to friends at home. Of California he writes: "Well does it merit its name. The heat is intense and the dryness of the atmosphere invariable, not infrequently 129 degrees, which, if I mistake not, is not exceeded in Africa or Persia. In this fine country how I lament the want of such majestic rivers as the Columbia!"

From time to time he contrived to make excursions to the interior and into the mountains of the coast, until the end of April, when he undertook a journey to Santa Barbara about May 15.

During one of these excursions from Monterey into the mountains, Douglas had the good fortune to discover this secluded Bristlecone Fir, which he announces thus to his learned friend Hooker: "I will now mention another new Pine to you, *Pinus venusta*, which I discovered last March (1831) on the high mountains of California (you will begin to think that I manufacture Pines at pleasure). As my notes are not at hand" (they were subsequently lost), "I must describe from memory." Unfortunately, he had no opportunity to revise and correct his descriptions aided by his notes, as he lost his life soon after in the Sandwich Islands.

In the numerous published descriptions of this lovely Fir, another pioneer explorer is always connected with its discovery—to wit, Dr. Thomas Coulter.

Dr. Coulter arrived in Monterey in November 1831, from the south, having the previous season explored the Central States of Mexico.

Douglas gave the doctor a warm welcome to California. "Since I commenced this letter," he writes to Hooker, "Dr. Coulter has arrived. He is a man eminently calculated to work, full of zeal, very amiable, and I hope may do much good to science. I do assure you from my heart it is a terrible pleasure to me to meet a really good man, and one with whom I can talk on plants."

They had often met before, and around the fitful camp-fire had passed many a night in botanical converse. Little did the two friends dream then that soon they would be for ever separated, and that inadvertently many of the discoveries of Douglas in the vicinity of Monterey would be credited to Dr. Coulter. Coulter also visited the locality of the new Fir, procured good specimens, which, with other Conifers, he carried home. David Don, describing them in the Linn. Trans. 1837, not only ignored Douglas's name of *Pinus venusta*, published a year previously, but gave the credit of discovery to Dr. Coulter, thus: "*Pinus bracteata*, discovered by Dr. Coulter on the Santa Lucia Mountains of California, at an elevation of 6,000 feet," &c. Lambert, in 1842, quoted Don; and the following botanists, Antoine, Hooker, Endlicher, Walpers, Parlatore, and McNab, all continue the name of *bracteata* (J. G. Lemmon).

This is one of the most strikingly beautiful of all the Silver Firs. It is one of those few plants which is happy in an historical

sense. It is easily recognised even without the cones, its source of origin is known, and there is little or none of the ambiguity and imperfect knowledge concerning it which are so fruitful in differences of opinion and so productive of vexatious synonyms in other cases. It was introduced to England by William Lobb, who in a letter to Messrs. Veitch, written from California, says: "This beautiful and singular tree forms here the most conspicuous ornament of the arborescent vegetation. On the western slopes, towards the sea, it occupies the deepest ravines, and attains a height of 120 to 150 feet, and 1 to 2 feet in diameter. The trunk is as straight as an arrow; the lower branches decumbent; the branches of the upper part are numerous, short, and thickly set, forming a long tapered pyramid or spire, which gives to the tree that peculiar appearance which is not seen in any other kinds of the *Pinus* tribe. When standing far apart, and clear from surrounding trees, the lower branches frequently reach the ground, and not a portion of the trunk is seen from the base to the top.

"Along the summit of the central ridges, and about the highest peaks, in the most exposed and coldest places imaginable, where no other Pine makes its appearance, it stands the severity of the climate without the slightest perceptible injury, growing in slaty rubbish, which to all appearance is incapable of supporting vegetation. In such situations it becomes stunted and bushy, but even then the foliage maintains the same beautiful dark green colour, and when seen at a distance it appears more like a handsomely grown Cedar than a Pine. No doubt it is one of the hardiest trees of the Californian vegetation, and is equally well adapted for clothing the mountain tops as the sheltered valley.

"The cones, too, are quite as singular as the growth is beautiful; when fully developed the scales, as well as the long leaf-like bracts, are covered with globules of thin transparent resin, presenting to the eye a curious and striking object.

"Douglas was mistaken in saying that this Fir does not occur below 6,000 feet of elevation. On the contrary, it is found as low as 3,000 feet, where it meets *Taxodium sempervirens*."

Later on the tree was met with by Beardsley, who, in the "*Pinetum Britannicum*," gives the following particulars concerning it:—

"I have never seen any description that does justice to this most beautiful of all the Firs. It rises to the height of 130 feet, straight as a line, the trunk tapering regularly from the ground to the top; clothed with branches which are slim and graceful down to the ground; the outlines of the branches taper almost as regularly as the trunk, giving the appearance of an elongated pyramid, as Hartweg describes it; but I would rather call it a tall spire, with a pyramidal base of two-thirds of the lower part of the tree. The pencil of the artist could not give it a more regular shape than it appears in nature. I

saw no tree deprived of its lower branches, except in thickets where it was impossible for them to grow ; there was not one, with the above exceptions, that I could not step from the ground on to its branches. Not the least remarkable thing is that these branches bear fine foliage down to the ground, and the branchlets often touch the ground. I have found it occupying exclusively the calcareous district abounding with ledges of white, veined, and grey marble."

Some writers say the plant grows on calcareous soil, while Vasey met with it on moist, cold soil.

The remarkable length of the bracts sets one wondering what their purpose can be. Can it be that the scales remain attached to the bracts as they fall, and that these insert their long points into the *débris* of leaves on the surface of the soil, and so serve to "dibble the seed in"? We do not know. We only say, Can it be? Douglas compared the cones to the inflorescence of a *Banksia*. We submitted a cone to the inspection of non-botanical friends, who pronounced it to be a Teasel or a Thistle—comparisons which aptly denoted the appearance of the cones (*Gardeners' Chronicle*, February 1889, p. 242).

Too much cannot be said in favour of this little-known tree, for, with its long and thick deep-green foliage, erect habit, and pleasing contour, it is beyond doubt one of the handsomest of the many Conifers with which California has enriched our empire. The largest, best-furnished, and most healthy specimen of *A. bracteata* that I have seen is growing in a soil largely composed of peat, and partially sheltered from the prevailing winds of the district. After becoming established the upward growth of this tree is fairly rapid, the annual addition to the height of the specimen referred to, for five consecutive years, averaging 13½ inches. Being of recent introduction, few opportunities of testing the quality of the timber have been afforded. Introduced in 1853 (*Trans. Roy. Scot. Arb. Soc.* xii. pt. 2).

Seems to be quite hardy in Denmark.

A. cephalonica, Link in Linnæa, xv. 529 ; Loud. Arb. Brit. iv. 2325, f. 2235-36. *Pinus cephalonica*, Endl. Cat. Hort. Vindob. i. 218, and Conif. 98. *P. Abies* β *cephalonica*, Parl. in DC. Prodr. xvi. 2, 422. *Picea cephalonica*, Loud. Encycl. of Trees, 1039, f. 1940-46. *A. panachaica*, Heldr. Pl. Exsicc. *A. Luscombeana*, Loud. Arb. iv. 2325 (*cum ic.*). *A. pectinata* γ *cephalonica*, Cat. Sem. h. Vratis. 1863. *Picea Kukulnaria*, Wender d. Pfl. Bot. Gärten, 11.

Habitat.—Mount Enos (now Monte Negro), in the island of Cephalonia, whence its specific name. Also throughout Greece, on the mountains, from 3,000-5,000 feet elevation, forming dense forests (Parl. in Prodr. xvi. 422).

Mr. Loudon observes that the merit of introducing *Abies cephalonica* into England entirely belongs to General Napier, and that it never was heard of in any public collection, or in nurseries, till 1824. The plant sent to the Plymouth nursery was, in 1837,

sold to the Duke of Bedford for twenty-five guineas. Two of those sent to the Exeter nursery were sold to the Rev. Theodore Williams, of Hendon Rectory, for about the same sum each ; and the third was retained as a stock plant to propagate from.

A fine tree, growing upwards of 60 feet high, with a trunk 9 or 10 feet in circumference, and a spreading head. Timber very hard and durable. It is called the White Cedar by the Greeks.

This handsome Fir is well adapted for general use in our country, and, whether planted singly on the lawn, or mixed with others in the woodland, is at all times a pleasing object and worthy the attention of planters. Unfortunately, in some districts, and especially when planted in unsuitable situations, young trees are apt to suffer from late spring frosts. That, however, should be no detriment to its extended use, as, by a proper selection of soils and sites, success in the cultivation of this tree is not difficult. A stiffish soil, such as a good clayey loam, thoroughly drained, and a northern or western aspect, will be found most suitable, as these considerably retard early growth, the great evil to which the tree is susceptible in our clime.

As an ornamental Conifer this is of not less than second-rate importance, the long and lithe branches being well clothed with dark olive-green foliage, while the whole contour of the tree is remarkably pleasing. The timber of home-grown trees, which I have used experimentally for several purposes, appears to be good and durable, but sufficient time has not elapsed since the experiments were made to speak with certainty ; so far, however, they are satisfactory, and tend to prove that the wood, when of mature age, will be of value for many outdoor purposes. According to General Sir Charles Napier, the timber produced in its native wilds is of excellent quality ; and he informs us that, in pulling down some houses which had been built from a hundred and fifty to three hundred years before, the wood from the Black Forest (on the Black Mountain, Cephalonia) was found as hard as oak, and perfectly sound. In the seventeenth century wood was supplied from this forest for the whole of the Ionian group of islands, as well as for the arsenal in Corfu. The wood is extremely resinous. Under favourable circumstances, the rate of growth is about 10 inches a year ; but the production of timber is somewhat slow. Three specimens of fifty years' growth, which I measured, were 38 feet each on an average, or about 9 inches annually since they were planted. Introduced from Cephalonia in 1824 (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

Introduced by the Court gardener, Schmidt, from Athens into Germany in 1856.

This species has attained a height of 44 feet and a girth of 6 feet, forty years after being planted, in the gardens at Carlsberg, near Copenhagen. One planted in 1864 now measures 28 feet high and 1 foot 10 inches in girth.

In Norway it may be seen at Christiania of about 10 feet in height, and in Sweden it thrives as far north as Stockholm.

A. c. var. Apollinis. *A. Apollinis*, Link in Linnæa, xv. 528. *Pinus Apollinus*, Ant. Conf. 73. *P. Abies* β *Apollinis*, Endl. Syn. Conf. 96. *P. Abies*, Du Roi, *P. Apollinis*, Link, Christ. Europ. Abiet. *P. Picea* β *gracea*, Fraas f. Class. *Abies pectinata* β *Apollinis*, Lindl. and Gord. Journ. Hort. Soc. v. 210; Laws. Pinet. Brit. v. cum ic. *Picea Apollinis*, Rauch, Gord. Pinet. Suppl. 44. *P. cephalonica Apollinis*, hort. *Abies cephalonica parnassica*, Henk. and Hochst. Syn. 181.

Introduced into Central Europe about 1850.

A tree of this variety planted in Denmark in 1870 now measures 31½ feet in height and 1 foot 10 inches in girth.

A handsome tree, rarely exceeding 60 or 70 feet in height and 2 or 3 feet in diameter, with an ample spreading head and smooth stem, covered with a pale yellowish brown bark, scarcely ever having on its surface any of those blisters containing resinous matter so commonly to be found on all the Silver Firs. It is found plentifully in many parts of Greece, forming extensive forests, at elevations varying from 1,500 to 4,000 feet, but more particularly in the southern parts, such as on the sacred Apollo, and on the celebrated and mighty mounts called Parnassus and Olympus, where in olden times mankind went in crowds to be deluded, and giants piled up in hopes to scale heaven. It is also found in the Morea, near Tripolizza, once the Turkish capital, in Central Arcadia, particularly on the eastern part of the plain, at the foot of Mount Mænalus, a region which even the ancients characterised as the "abode of winter." It is quite hardy, but, like the Mount Enos Silver Fir, suffers greatly (especially when young) from the late spring frosts, which so frequently destroy the young growth on many of our Silver Firs.

Much difference of opinion still exists among writers with respect to whether the Apollo Fir should be considered a distinct species, or only as a variety of the common Silver Fir, or Mount Enos Silver Fir. Professor Endlicher considered it as only a variety of *Picea pectinata*, while Professor Link made it a distinct species, in which opinion he has been followed by M. Carrière and some others, while I myself at first referred it to *Picea cephalonica*, to which it certainly is very nearly related, and frequently confounded with; but, after a careful examination of ample and excellent original specimens presented to me by Professor Link, I have come to the conclusion that he is right in considering it a distinct species, especially as it is always reproduced true from seed and retains its great diversity of foliage, the larger portion of which is generally more or less linear, dense, and blunt-pointed, while the remainder is more or less dagger-shaped, very acute pointed, thickly placed all round the shoots, and like those of *Picea cephalonica*.

A. c. var. Reginæ Amaliæ. *A. Reginæ Ameliæ*, Heldr.

Gartenfl. 1860, 113, and 1861, 286 (*cum ic.*). *A. cephalonica* β *arcadica*, Henk. and Hochst. Syn. 182. *A. peloponnesiaca*, Haage. *Pinus peloponnesiaca*, hort. *Abies pectinata* β *Reginæ Amaliæ*, Cat. Sem. Hort. Vrástislav, 1863. *Pinus Abies*, Du Roi (*b*) *Reginæ Amaliæ*, Heldr. Christ. Europ. Abiet.

This variety has been brought into notice by M. Heldreich, of Athens, under the name of *Abies Reginæ Amaliæ*, or the New Arcadian Fir, and with a statement that it was first obtained in 1856 by M. Schmidt, the Curator of the Royal Gardens at Athens, who at the time considered it new, and distinct from the Grecian, or Apollo Fir, and gave to it the name of *Pinus peloponnesiaca*, which name M. Heldreich afterwards changed to that of *Abies Reginæ Amaliæ*, in compliment to the Queen of Greece, a great patron of gardening. M. Schmidt, however, had never seen the tree, nor was anyone aware of its peculiarities, until Messrs. Balsamaki and Origoni, two inspectors of the royal forests, reached Khrysovitsi, a village in Central Arcadia, near Tripolitza, in the Morea, where, at an elevation of about 1,500 feet above the sea, they discovered a whole forest of this Fir, stretching in a north-westerly direction towards Alonistena, and covering Mount Rhaudia and the adjacent valleys, thus having an extent of above three leagues in length and one and a half broad. It is called by the country people "Hemeron Elaton" (Tame Fir), on account of the lower situations of its forests on the mountains, and the ready means for obtaining its timber for domestic purposes; while, on the other hand, they apply the term "Agrion Elaton" (Wild Fir) to *Picea cephalonica*, because of the inaccessible and lofty places where it in general grows. The inhabitants living near the large Fir forests are in the habit of ringing the stems, or cutting off the heads of the more vigorous trees at about two or three feet from the ground, for the purpose of obtaining the resin which flows from the wounds and upper part of the stumps, which stumps afterwards throw out a number of symmetrically formed shoots, the principal ones of which eventually, if undisturbed, become leaders, and form stems frequently 20 feet high and a foot in diameter (G. Gordon, "The Pinetum," 1875).

A. cilicica, Carr. Conif. ed. 2, 307. *Pinus cilicica*, Ant. and Kotschy, Oest. Bot. Wochenblatt, Dec. 1853, 409. *P. Tschugatskoi*, Fisch. Mss. *Abies Tschugatskoi*, Laws. ex Gord. Pinet. Suppl. 50. *Picea cilicica*, Rauch ex Gord. Pinet. *l.c.*

A tree from 40 to 60 feet high, inhabiting Mount Taurus, in Cilicia, in north-west Güllock, in company with the Cedar of Lebanon, at an elevation of from 4,000 to 5,000 feet, in Antitaurus and Afghanistan.

Seems to be hardy in Denmark.

A. concolor, Lindl. and Gord. Journ. Hort. Soc. Lond. 1850, v. 210. *Pinus concolor*, Engelm. ex Parl. in DC. Prodr. xvi. 2, 426. *Picea concolor*, Gord. Pinet. ed. 2, 216. *Abies Lowiana*, Murr *A. grandis*.

Habitat.—Northern slopes of the Siskiyou Mountains, Oregon, and perhaps farther north in the Cascade Mountains; south along the western slope of the Sierra Nevadas to the San Bernardino and San Jacinto Mountains, California; along the high mountains of Northern Arizona to the Mogollon Mountains, New Mexico; northward to the Pike's Peak region of Colorado, and in the Wahsatch Mountains of Utah.

A large tree, 100-130 feet in height, with a trunk 4-5 feet in diameter; moist slopes and cañons between 3,000 and 9,000 feet elevation, reaching its greatest development in the Californian Sierras; varying greatly in the colour and length of leaves, habit, &c., and perhaps merely a southern form of the too nearly allied *A. grandis*, from which it cannot be always readily distinguished.

Wood very light, soft, not strong, coarse-grained, compact; bands of small summer cells narrow, resinous, not conspicuous; medullary rays numerous, obscure; colour very light brown or nearly white, the sapwood somewhat darker; specific gravity, 0.3638; ash, 0.85; occasionally manufactured into lumber and used for packing-cases, butter-tubs, and other domestic purposes.

This species, planted in Danish gardens about 1864, now has a height of about 40 feet and a girth of 3½ feet. It has produced cones.

A. Eichlerii, Lauche, is probably the same as *A. Veitchii*.

A. firma, Sieb. and Zucc. Fl. Jap. ii. 15, t. 107. *A. Momi*, Sieb. Verhand. van het Batav. Genotsch. xii. 12; Koch, Dendr. 227. *A. bifida*, Sieb. and Zucc. Fl. Jap. ii. 18, t. 109; Carr. Tr. Gén. des Conif. 214. *A. homolepis*, Sieb. and Zucc. Fl. Jap. ii. 17, t. 108. *A. Webbiana*, Lindl. and Gord. (not Endl.) Journ. Hort. Soc. v. 211. *A. major*, Honso Sufu, 78. *Picea firma*, Gord. Pinet. 147. *P. Webbiana*, Gord. Pinet. 160 (partly 1858). *Pinus Webbiana*, Ant. Conif. 70, t. 27. *P. bifida*, Ant. Conif. 79, t. 31, f. 2. *P. homolepis*, Ant. Conif. 78, t. 31, f. 1. *P. Harryana*, MacNab. in Proc. R. Irish Acad. 689, t. 47, f. 16. *Abies Tschonoskiana*, Hort. Petrop.

Habitat.—Japan, but, according to H. Mayr, not further north than 40°.

Introduced in 1861 by Mr. J. G. Veitch.

Seems to be hardy in Denmark.

A. Fraseri, Lindl. in Penny Cyclop. i. n. 5. *Pinus Fraseri*, Pursh, Fl. Bor. Amer. ii. 639. *Picea Fraseri*, Loud. Arb. iv. 2340, f. 2243-44. *Abies balsamea* β *Fraseri*, Spach, Hist. Vég. Phan. xi. 422.

Habitat.—The highest summits of the Alleghany Mountains in North Carolina and Tennessee. Introduced in 1811 by Mr. Fraser, Lea Bridge, near London, after whom it is named.

A tree 60-80 feet in height, with a trunk sometimes 2 feet in diameter; moist slopes between 5,000 and 6,500 feet elevation, forming considerable forests.

Wood very light, soft, not strong, coarse-grained, compact; bands of small summer cells rather broad, light-coloured, not conspicuous; medullary rays numerous, thin; colour light brown, the sapwood lighter, nearly white; specific gravity, 0·3565; ash, 0·54 (C. S. Sargent).

A. Fraseri has in Denmark, in some gardens, as at Hæsede, Enium, &c., attained a height of about 30 feet. It has also produced cones. *A. balsamea* is often wrongly called "*Fraseri*" in nurseries.

Prof. F. C. Schübeler says, in his "*Viridarium*," that he has not seen this species elsewhere in Norway than at Molde (62° 44') and at the Botanic Gardens at Christiania, where formerly two plants were to be found. The tallest of these died in the summer of 1881, on account of the roots having got into a wet subsoil; it had several times given good germinating seeds. It was then 45 feet (14·1 m.) high, with a diameter at the base of 13 inches (34 cm.), and was forty years old.

In Sweden it does well at Stockholm, and also seems inclined to succeed at St. Petersburg.

A. grandis, Lindl. in Penny Cyclop. n. 3; Engelm. in Bot. Calif. ii. 118. *Pinus grandis*, Dougl. in Bot. Mag. Comp. ii. 147. *Picea grandis*, Loud. Arb. iv. 2344, f. 2245-46. *Abies Gordoniana*, Carr. Conif. ed. 2, 298. *A. amabilis*, Murr. *A. oregona*, hort.

Habitat. — Vancouver's Island; south of Mendocino County, California, near the coast; interior valleys of Western Washington Territory and Oregon; south of the Umpqua River; Cascade Mountains, below 4,000 feet elevation; through the Blue Mountains of Oregon (Cusick) to the eastern slope of the Cœur d'Allêne Mountains (Cooper); the Bitter Root Mountains, Idaho (Watson), and the western slopes of the Rocky Mountains of Northern Montana, Flathead region (Canby and Sargent).

A large tree, 200-300 feet in height, with a trunk 3-5 feet in diameter; most common, and reaching its greatest development, in the bottom-lands of Western Washington Territory and Oregon, in rich, moist soil; or moist mountain slopes, then much smaller, rarely exceeding 100 feet in height.

Wood very light, soft, not strong, coarse-grained, compact; bands of small summer cells broader than in other American species, dark-coloured, resinous, conspicuous; medullary rays numerous, obscure; colour light brown, the sapwood rather lighter; specific gravity, 0·3545; ash, 0·49; in Western Oregon manufactured into lumber and used for interior finish, packing-cases, cooperage, &c. (C. S. Sargent).

It was the first new tree to confront the great explorer, Douglas, on Cape Disappointment (the heavily wooded point south of the mouth of the Columbia River), where his vessel touched the coast (April 1825), after having been kept by the severe winter weather outside the bar for six weeks. Of the weather he declares: "The hurricanes of

North America are a thousand times worse than those of the noted Cape Horn."

At last, on the 7th of April, at 4 P.M., the ship came to anchor in Baker's Bay, just north of the mouth of the river, and "thus terminated my long and tedious voyage of eight months and fourteen days." But at once his circumstances change. "The night following I reckon as among the happiest moments of my life." "The greater part of the country," he states, "as far as the eye could reach, was covered with Pines of various species."

The Conifers (all called *Pinus* in his day) which gladdened the soul of Douglas a few days after on that promontory of Cape Disappointment were anything but disappointing to the storm-tossed botanist. There were at least eight species, representing as many genera, as we now know them, all within the radius of his vision: *Pinus contorta* growing on the drifting sand of the outer shore; *Tsuga Mertensiana* and *Picea sitchensis* next in the moist, swampy slopes of the promontory; the great *Thuja gigantea*, forming the greater part of the brow of the promontory, with the monster Fir, *Abies grandis*, and the great False Spruce, which was thereafter to bear his name, *Pseudotsuga Douglasii*, crowning the elevation; while in deepest shade, by spring or stream, shone the bright-leaved Alaska Cedar, *Chamæcyparis nuthkaensis*, and the Western Yew, *Taxus brevifolia*.

On stepping out of the boat he picked up *Rubus spectabilis* and *Gaultheria Shallon*, and the first tree he reached was a new one which, on account of its great size, he named *Pinus grandis*, though he did not report his discovery until five years later (1830).

In 1836 he published it under that name in the "Companion to the Botanical Magazine." Subsequently (1837) Dr. Lindley published it in the "Penny Cyclopædia" as *Abies grandis*, and this being the present reference, he thus becomes the author of the species (J. G. Lemmon, "California Board of Forestry," 1889-90).

Introduced in 1831. This is not only a grand ornamental tree, but the most rapid grower of all the Silver Firs. In its native habitat, in low, moist situations, it grows to 280 feet in height, and often girths 21 feet. Such enormous growth may well tempt us to plant it more frequently. It is extremely well adapted for ornamental planting, the soft, rich green foliage, densely branched stem, and symmetrical habit being recommendations rarely combined in one species. The timber produced in this country is of excellent quality, being weighty, resinous, and the concentric rings firmly packed. The largest specimen which I have cut down—and only stern necessity compelled its removal—was, exclusive of the broken top, 72 feet in height, measured 26 inches in diameter at the butt end, and contained 73 feet of timber. On measuring some of the annual rings near the bark I found them to average an inch in thickness, which speaks highly in favour of the tree as a rapid timber-producer. When felled and

stripped of its branches, the balsamic fragrance, from the quantity of resin the tree contained, was perceptible at a considerable distance—further than I have ever noticed even in the Douglas Fir—and the circumstance was commented upon amongst the woodmen employed in removing it. The average upward rate of growth of *A. grandis* in this country is 17 inches, while the quantity of timber produced in fifty years by the large specimen referred to gave an annual average of nearly 1½ cubic foot. When cut into boarding the wood resembled in appearance the common Silver Fir, but was perhaps darker, of greater specific gravity, and of firmer texture. It works well and takes a good polish; but, from the rapid rate of growth, the graining is somewhat rough, though perfect in delineation. The timber was used experimentally for many purposes; but sufficient time has not yet elapsed for us to speak with certainty regarding its lasting qualities. So far, however—and it is now five years since the tree was felled—it seems quite sound, and likely to remain so for many years to come. A comparison of the timber of this tree grown in Britain with that exhibited from British Columbia at the Colonial and Indian Exhibition revealed but few differences, and nothing more than might be expected between that of a partially developed and of a mature tree. Taking into consideration the quantity and quality of wood produced by *A. grandis*, as also its highly ornamental appearance and undoubted hardihood, we place it in the front rank for economic planting in the British Isles. The soil best suited for it is an open, rich loam, where it will not suffer either from excess or want of moisture (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

A. grandis thrives very well in some parts of Denmark; one planted in 1864 now measures 53 feet in height and 6 feet in girth.

A. homolepis, Sieb. and Zucc. *Pinus Harryana*, MacNab, Proc. R. Irish Acad. 1876. *P. Tschonoskiana*, Neumann, Cat. ex Parlatore.

The name *homolepis* is, according to Dr. H. Mayr, to be preferred to the now perhaps more common one of *A. brachyphylla*.

A. magnifica, Murr. Proc. Hort. Soc. Lond. 1862, iii. 318, f. 25-33. *A. amabilis*. *A. campylocarpa*, Murr. in Trans. Bot. Soc. Edinb. vi. 370. *A. nobilis robusta*, Carr. Conif. ed. 2, 269. *Picea amabilis*, Lobb. *Pinus amabilis*, Parl. in DC. Prodr. xvi. 2, 426. *Abies nobilis* var. *magnifica*, Masters, Linn. Soc. Journ. 1887, xxii. 189. *Pseudotsuga magnifica*, MacNab in Proc. R. Irish Acad. ser. 2, ii. 700, t. 49, f. 30 and 30a. *Picea magnifica*, hort.

Habitat.—California, Mount Shasta, south along the western slope of the Sierra Nevadas to Kern County.

A large tree, 200-250 feet in height, with a trunk 8-10 feet in diameter, forming about the base of Mount Shasta extensive forests, between 4,900 and 8,000 feet elevation; farther south less common, and reaching an extreme elevation of 10,000 feet.

Wood light, soft, not strong, rather close-grained, compact, satiny

durable in contact with the soil, liable to twist and warp in seasoning; bands of small summer cells broad, resinous, dark-coloured, conspicuous; medullary rays numerous, thin; colour light red, the sapwood somewhat darker; specific gravity, 0·4701; ash, 0·30; largely used for fuel, and occasionally manufactured into coarse lumber (C. S. Sargent, "Forest Trees of North America").

It is hardy in Denmark.

A. Mariesii, Mast. in Gard. Chron. 1879, 788 (*cum ic.*); Linn. Soc. xviii. 519; Veitch, Man. Conif. 100; H. Mayr, Monogr. d. Abietineen des Jap. Reiches, 40.

Habitat.—Japan, at Awomori, and on Mount Nikko, 5,000 to 7,000 feet elevation, in company with *A. Veitchii*, growing in shallow peat on volcanic *débris*.

Introduced by Messrs. James Veitch & Sons in 1879, through their collector, Mr. Maries, after whom it has been named.

Seems to be hardy in Denmark.

A. nobilis, Lindl. in Penny Cyclop. i. n. 5. *Pinus nobilis*, Dougl. Mss. in Comp. Bot. Mag. ii. 147. *Picea nobilis*, Loud. Arb. Brit. iv. 2342, f. 2249-50. *Pseudotsuga nobilis*, Bertrand in Bull. Soc. Bot. Franc. xviii. 86.

Habitat.—Oregon, Cascade Mountains, from the Columbia River south to the valley of the Upper Rogue River, and along the summits of the coast ranges from the Columbia to the Nootucca River (Collier).

A large tree, 200-300 feet in height, with a trunk 8-10 feet in diameter, forming, with *A. amabilis*, extensive forests along the slopes of the Cascade Range, between 3,000 and 4,000 feet elevation; less multiplied in the coast ranges, here reaching its greatest individual development.

Wood light, hard, strong, rather close-grained, compact; bands of small summer cells broad, resinous, dark-coloured, conspicuous; medullary rays thin, hardly distinguishable; colour light brown streaked with red, the sapwood a little darker; specific gravity, 0·4561; ash, 0·34 (C. S. Sargent, "Forest Trees of North America").

Abies nobilis is also one of the discoveries of the late Mr. Douglas, who found it in large forests in North California, where it forms a majestic tree, producing timber of an excellent quality. Douglas says he spent three weeks in a forest composed of this tree, and day by day could not cease to admire it.

This tree is one of the hardiest and handsomest of the group, and is becoming tolerably common. Amongst the Silver Firs it is the most conspicuous and beautiful, the deep glaucous foliage, regularly disposed branches, and by no means stiff outline, being special recommendations. Few trees are less particular about the quality of soil in which they are planted. It is of rapid growth, the average annual increase in height of several specimens of which I kept a record being 20 inches, for a period of twenty-five years. The produc-

tion of wood is likewise rapid, and in support of this statement one of many instances which came under my notice may be cited. A tree of this kind was planted in good soil and a sheltered southern situation in 1854, at that time being a robust-growing specimen of 3 feet in height. In 1884, or thirty years afterwards, it had attained to 55 feet, when it was found to contain 61 cubic feet of wood, giving an average annual increase of fully 2 cubic feet.

The home-grown timber of *A. nobilis* is not of first-rate quality, it being, in every instance where I have had the chance of examining it, soft, easily worked, and clean-grained. The timber of mature trees will no doubt be of better quality than that of specimens of thirty years' growth. Introduced in 1831 (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

A. nobilis is to be seen in Danish gardens of an age of about thirty years, and approaching 20 feet in height. It has produced cones in some gardens.

A. Nordmanniana, Link in Linnæa, xv. 528; Spach, Hist. Vég. Phan. xi. 418. *Pinus Nordmanniana*, Stev. Bull. Soc. Nat. Mosc. 1838, 45, t. 2. *Picea Nordmanniana*, Loud. Encycl. of Trees, 1042, f. 1950.

Habitat.—Discovered on the top of the Adschar Mountains of the Crimea by the Finnish professor, Alexander Nordmann. It is also to be found in the Western Caucasus. In the neighbourhood of Aschur it forms large forests mixed with *A. orientalis*. It is not to be found farther east than Tiflis.

Introduced into Europe in 1848, when Alexander von Humboldt obtained seeds from the Caucasus, which were sown in the Berlin Botanic Gardens.

If *A. nobilis* be the best of the Californian Silver Firs, this is, without doubt, the finest and most valuable of the European or Asiatic species. As a lawn tree it can scarcely be surpassed, the handsome and regular outline, rich glossy green foliage, and stately habit rendering it one of the handsomest of Conifers for ornamental planting. We expect that at no distant date it will supplant the common Silver Fir for forest planting; the timber is of excellent quality, the tree more ornamental, and as regards soil it is less exacting. Another advantage it has over the common Silver Fir is that, owing to starting into growth later in the spring, it is less apt to be injured by unseasonable frosts. Few trees are less particular as to soil than Nordmann's Fir; it succeeds well in reclaimed peat-bog, stiff loam, decomposed vegetable matter, and light gravelly soils. For planting on cold, steep declivities, in the vicinity of water, in is invaluable, and succeeds well where the common Silver Fir, and even the Larch, become seared and unsightly. The timber produced in this country is hard, close-grained, very lasting, and susceptible of a fine polish. It is superior to that of the common Silver Fir, being harder and firmer in texture, and should its durability prove equal to that

species it will be one of the most valuable timbers (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

The timber of *A. Nordmanniana* and *A. Pinsapo* I consider the best of the Silver Firs, not excepting even the prototype *A. pectinata* (Nelson, Pinac.).

A. Nordmanniana has at an age of about thirty years measured 40 feet in height and 3 feet in girth. It is often planted in Danish gardens and forests, and is quite hardy.

It is said to thrive well at Drontheim (Trondhjem) in Norway, and trees of from 1 to 2 feet in height have even done well at Hernsand (62° 38') ("Tidning för Trädgårdsodlare," Stockholm, 1878 and 1880).

A. numidica, De Lannoy, Carr. Rev. Hort. 1866, 106, 168. *A. Pinsapo* var. *laboriensis*, Cosson, Bull. Soc. Bot. Franc. 1861; Ann. Soc. d'Acc. 1863; Compend. Fl. Atl. 1881. *A. laboriensis*, Letourneux, Cat. des Arb. et Arbust. d'Algérie, 1888.

Habitat.—North Africa. Kabilia in Algiers; near the summit and on the northern aspect of Mounts Tabor and Babor, at an elevation of from 4,000 to 6,000 feet, sparingly interspersed with the Mount Atlas Cedar.

Introduced into France in 1862 by Davont, and in 1864 by De Lannoy, superintendent of roads and bridges in the province of Constantia; and subsequently received in England. It was discovered in 1861 by Captain de Guibert.

Several young plants have done well in Denmark, and do not seem to have suffered in any way from the severe winter of 1890-91.

A. Parsonsiana, hort. Barron.

Seems to be hardy in Denmark.

A. pectinata, De Cand. Fl. Fr. ii. 275. *A. femina* S. Elate, J. Bauh. Hist. i. 2, 231. *A. conis sursum spectantibus* s. *mas*, C. Bauh. Pin. 505. *A. taxifolio fructu sursum spectante*, Tourn. Inst. 585. *Abies*, Plin. Hist. Nat. xvi. 18; Cæsalp. de Plant. lib. iii. cap. 53, p. 133. *A. alba femina*, C. B. Elssh. 295. *Pinus Picea*, Linn. Spec. Pl. 1420. *P. Abies*, Du Roi, Observ. Bot. 39; Endl. Conif. 95. *P. Abies*, Du Roi (*a*) *pectinata*, Christ. Europ. Abietineen. *P. pectinatus*, Lam. Fl. Franc. ii. 202. *Abies alba*, Mill. Dict. n. 1. *A. vulgaris*, Poir. Dict. suppl. vi. 514. *A. taxifolia*, Desf. Cat. Hort. Paris. ed. 3, 356. *A. Picea*, Lindl. in Penny Cyclop. n. 1. *A. excelsa*, Link in Abhandl. d. Berl. Akad. 1827, 182. *A. candicans*, Fisch. Mss. *A. argentea*, De Chambr. Tr. Prat. Arb. Résin. 17, t. 1, figs. 1, 2, and t. 5, fig. 1. *Picea pectinata*, Loud. Arb. Brit. iv. 2329, f. 2237-39.

Habitat.—In the mountain districts of Central and Southern Europe (sparsely in the Apennines), as far westward as the Pyrenees, and extending eastward to the Transylvanian Alps, the Carpathians, and the Caucasus. Its northern limit is about lat. 50°, beyond which it is found only in cultivation.

Introduced into England in the sixteenth century, but the precise date is unknown. It is described by Gerarde, in his "Historie of Plantes," 1597, under the name of the Pitch-tree.

As an ornamental tree it is only of secondary importance, but for the value of the timber it produces it is well worthy of attention, although its merits in this particular have been exaggerated. The timber is of fairly good quality, and well fitted for rough outdoor carpentry. The timber is elastic, and the graining irregular, while it is soft, apt to shrink, and soon decays on exposure. For temporary buildings, tool-sheds, cattle-shelters, and many such purposes we have used the best quality of Silver Fir timber produced in this country, and with satisfactory results. It is excellent for use in connection with sluices and dams, or for lining the banks of streams and rivulets. Except the Larch, we may say that the Silver Fir is second to none of the Firs that have been introduced for upwards of a hundred years for the value of the timber which it produces.

A. pectinata was planted about one hundred and twenty-five years ago in the Jægersborg deer park at Klampenborg, a few miles from Copenhagen. Many of the trees have developed into most beautiful specimens, and travellers who have seen this Silver Fir in its native habitats are generally astonished to find that it attains perhaps greater perfection in Danish forests than in its native haunts. But it is not only in Zealand that this species grows into real magnificence; in Jutland also fine examples of it are to be seen. According to a statement of measurements taken in 1874, on Count Frijs's estate at Frijsenborg, in Jutland, a Silver Fir, planted about one hundred and ten years ago, measured 120 feet high. The above-mentioned trees in the Jægersborg deer park were measured in 1882, and are reported to have given a height of only a couple of feet less.

A forester who at the end of 1891 measured some of the trees in the deer park now estimates them to be not far short of 140 feet. He has also measured several in the vicinity of Copenhagen, and states the measurements to be 134, 132, 130, 128, 121, 107, and 105 Danish feet (an English foot is the equivalent of 0.971 Danish foot). The circumference of the stems, breast high, he has given me as follows: 13.7, 13.2, 12.1, 9.8, 9.5, 9.3, and so on, counted in Danish feet.

According to information supplied by Baron F. Rosenkrantz, trees of this species were planted a hundred years ago on the beautiful Danish chalk and limestone island of Møen, and when recently measured were found to be about 100 feet high, with a girth (three feet from the ground) of 11 feet, while others were somewhat less.

On free, well-drained ground this variety is to be found even as far north as Upsala.

A. p. fastigiata, Booth (the Upright Common Silver Fir). *A. pectinata stricta*, Carr. *A. metensis*, hort. Paris. *A. pyramidalis metensis*, Carr. *Picea pectinata metensis*, hort. *P. metensis*, hort.

Leaves short, slender, frequently curved upwards, and much smaller than those of the species.

The branches of this variety of the common Silver Fir are turned upwards on the main stem, but with their ends and branchlets curved, and more or less drooping.

It has a narrow, conical head, resembling that of the Lombardy Poplar in outline, but with a drooping appearance when closely inspected. A very striking variety, of German origin.

A. p. pyramidalis, hort. (the Pyramidal Common Silver Fir). *A. pectinata pyramidalis*, Carr. *Picea pyramidalis*, hort. *P. taxifolia pyramidalis*, Makoy.

This singular variety originated at Metz, and differs from the preceding in having its branches and branchlets more erect, slenderer, thinner, and much compressed, and in the full-grown trees having an erect pyramidal shape like the Lombardy Poplar.

A. p. stricta, hort. Carr. Conif. ed. 1, 207. *A. pyramidalis metensis*, hort. *A. pectinata pyramidalis*, hort. *A. pectinata Rinzi*, hort. *A. metensis*, hort. *A. Rinzi*, hort.

A. Pindrow, Spach. *Pinus Pindrow*, Royle, Himalay. 354, t. 86. *Abies Webbiana* β *Pindrow*, Brandis, Forest Flora, 354, t. 86. *Picea Pindrow*, Loud. Arb. iv. 2346, f. 2254-55. *P. Herbertiana*, Madd. *P. Naphta*, Knight, ex Gord. Pinet. 157. *Pinus Naphta*, hort. Ant. Conif. 80. *Abies Pindrow*, Spach, Hist. Vég. Phan. xi. 423. *Taxus Lambertiana*, Wall. Cat. No. 6056.

Habitat.—Himalaya Mountains, to about 10,000 feet high, in the valley of the Sutlej, &c. Introduced into Europe in 1837 by Royle.

Professor Don observes that *A. Pindrow* is liable to be confounded with *A. Webbiana*, but that the former is readily distinguished from the latter by its longer and acutely bidentate leaves of nearly the same colour on both surfaces, and by its shorter and thicker cones with trapezoid-formed scales, and rounded, notched bracteoles. Dr. Royle, who appears to have been the only botanist who found the tree either in flower or in fruit, states that it grows to a large size, varying from 80 feet to upwards of 100 feet in height, with widely spreading branches, and that he met with it at an elevation of 1,000 feet above the level of the sea.

A noble tree, with flat, horizontal branches, in regular, distinct whorls, found abundantly in Bhotan, from 11,000 to 12,000 feet of elevation. In Kamaon it is found at from 7,500 to 9,000 feet of elevation, where it clothes the sources of the Kosilla, in a forest of unusual gloom and thickness. It also grows on the easternmost range of the Himalayas, where it is called "Rayha," also on the Khoor and Kedarkanta Mountains, at elevations of from 8,500 to 12,000 feet, and on all other ranges of similar height, where the trunks attain a great girth and height, some of the trees on the Khoor Mountains measuring 20 feet round at five feet from the ground, and

upwards of 150 feet high, with the stem densely clothed with short, scrubby boughs, bearing little proportion in length to the height of the tree, and generally ending in a mass of flat, declining branches.

The Indian term "Pindrow," according to Major Madden, refers to its very peculiar mode of growth, the tree being tall and cylindrical, or slightly tapering, like the Lombardy Poplar; but, according to Dr. Wilson, it is derived from the Sanscrit words "Pind" (incense) and "Roo" or "Row" (to weep), from the numerous resinous tears found on the cones and other parts of the tree. It is also called "Kala-rai" (Black Fir) by the people along the Snowy Mountains, who also apply the term "Kalabun" (Black Forest) to the woods where it alone grows, from the dark green of the leaves on the upper surface giving the trees a sombre Yew-like appearance at a distance, which causes the mountaineers constantly to confound it with the "Thooner" (Yew), and which no doubt led Dr. Wallich (who trusted too much to local names) to give to this Fir the name of *Taxus Lambertiana*, he not having at the time seen its cones, or even, probably, the living tree. Its Khasiya name is "Ragha," and the Bhotiyas call it "Woomun" (purple cone).

This tree forms dense forests on all the great spurs of the Kamaon Alps, from 7,500 to 9,000 feet elevation, but under proper conditions it will ascend and descend above and below these elevations, always, however, exhibiting its preference for northern and western aspects. Mr. Winterbottom found it plentiful on the Peer Punjal in Cashmere, flowering in April and May, and ripening its cones, which are of the same rich purple colour as those of *Picea Webbiana*, in October and November of the same year (G. Gordon).

A. Pindrow is only to be found in Danish gardens under twenty years of age. One above that age stands in Jutland, and is said to have attained a height of more than 20 feet. Another at Vallo, on Zealand, somewhat less developed, has produced cones on several occasions.

A. Pinsapo, Boiss. in Bibl. Univ. de Genève (1838) in Elench. Pl. Hisp. n. 197, and Voy. en Espagne, ii. 584, t. 167-169. *Pinus Pinsapo*, Boiss. in Epist. and Ant. Conif. 65, t. 26, f. 2. *Abies hispanica*, De Chambr. Tr. Prat. Arb. Résin. 339. *Picea Pinsapo*, Loud. Encycl. of Trees, 1041, f. 1947-48.

Habitat.—The mountains in the middle, and especially in the south of Spain, on Sierra Bermejo, and Sierra de la Nieve; abundant on the Sierra Nevada, at elevations of from 3,000 to 4,000 feet.

Forests of this tree are found in the mountainous sub-alpine district of Grenada, in Spain, where it is clearly the representative of its allies *A. cephalonica* and *A. cephalonica Apollinis*, which are found in Cephalonia and Greece, in nearly the same latitudes. Among other mountains in Grenada the following have been specially noted as abounding with it: the upper part of the Sierra Bermejo,

above Estepona; the upper half of the Sierra Nevada; and the province of Ronda, at a height of from 3,500 to 6,000 feet. It is probably also found on the Cerro of San Christoval. Mr. Gordon says that it prefers the northern exposures, and that it reaches even near the summits, where the snow lies at least four or five months in the year. It is also said to be met with in some parts of the opposite coast of Morocco.

Regarding the quality of timber produced in Scotland I can say little; it closely resembles, both in colour and texture, that of the Silver Fir; but the samples which came into our hands were not sufficiently matured for a decided statement to be given. The average rate of growth of *A. Pinsapo*, under favourable conditions, is 14 inches annually, while in one instance at least we have known it to produce 30 feet of timber in an equal number of years. A native of Spain. Introduced in 1839 (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

Very fine trees of about 50 feet high, or even more, may be seen in several Danish gardens. It has also produced cones there.

Professor F. Schübelers says, in his "Viridarium," that the largest tree he had seen in Norway was at Christiansand; it was 14 feet high, with a circumference of 18 inches, and a spread of branches 14 feet in diameter.

I saw some in Sweden; it thrives well in Skaane, but not so well at Stockholm.

Introduced into England in 1839.

A. religiosa, Lindl. in Penny Cyclop. i. n. 6. *Pinus religiosa*, H. B. and Kth. Nov. Gen. and Spec. ii. 5. *Picea religiosa*, Loud. Arb. iv. 2349, f. 2257. *Pinus hirtella*, H. B. and Kth. l.c. *Abies hirtella*, Lindl. in Penny Cyclop. n. 11. *Picea hirtella*, Loud. Arb. iv. 2349.

Habitat.—*A. religiosa* is a native of various parts of Mexico and Guatemala, between latitudes 15° and 20° N., but always at a very high elevation, and in some places at the extreme verge of arborescent vegetation.

A. religiosa is one of the most beautiful of the Silver Firs, forming a tree of 150 feet high on the mountains ranging between 15° and 22° of N. latitude, and ascending to an elevation of 9,000 feet. It derives its name "*religiosa*" from the fact that the Mexicans make use of the branches to decorate their churches (*Gardeners' Chronicle*, January 10, 1885, p. 56).

In the cañons on the largest mountains it becomes a very symmetrical tree. On the upper limit of vegetation, as on Popocatepetl, it is dwarfed to a flat-topped bush. The cones are small, 3 to 5 inches long, with the bracts long and exerted like its congeners, *A. Fraseri* of the Eastern States and *A. nobilis* of Oregon.

The Mexican Fir is much used in the ornamentation of parks, and in the decoration of churches and cemeteries by the native devotees

of the warm south land, who regard this tree, holding out its waving branches from the lofty Cordilleras, much as did the ancient worshippers of the Cedar of Lebanon in the valley of Palestine, as a benison of good, blessing by the fragrance of its foliage and the healing qualities of its balsam (J. G. Lemmon).

A. sachalinensis, Masters, Gard. Chron. 1879; Journ. Linn. Soc. xviii. 517; Veitch, Man. Con. 106 (1881); Cat. of Plants in Bot. Gard. Tokio (1887). *A. Veitchii* var. *sachalinensis*, F. Schmidt, Reisen im Amurland und auf der Insel Sachalin, in Mém. de l'Acad. Imp. des Sciences de St. Petersb. ser. 7, t. 7, No. 2.

Habitat.—Of this Silver Fir there is to be found in Japan, besides the typical form, a variety which Mayr calls *nemorensis*. He says that the typical form occupies West Eso and Sachalin, and that the *nemorensis* lives on the mountains of North-east Eso and on the Kuriles; both attain 130 feet in height. It was brought to England in 1879 by Maries.

Hardy.

A. sibirica, Ledeb. Fl. Alt. iv. 202. *Pinus sibirica*, Steud. Nomenclat. ii. 338. *P. Picea*, Pall. Fl. Ross. i. 7 (excl. syn. and pl. Caucas.). *P. Pichta*, Fisch. ex Lodd. Cat. 1836, 50; Endl. Conif. 108. *Picea Pichta*, Loud. Arb. Brit. iv. 2338. *Abies Pichta*, Forb. Pin. Wob. 109, t. 37.

Habitat.—Siberia, from the Ural Mountains to Kamschatka and Mongolia, but is most abundant on the Altai (2,000 to 2,400 feet) and other ranges of mountains that stretch across the continent from the Caspian Sea to the Sea of Okotsk, forming vast forests at elevations of from 2,500 to 5,000 feet, in Russia between Vologda and the Middle Volga.

Introduced in 1820. This species only succeeds well in damp, stiff land. The leaves are dark green above and silvery beneath, and when shaken by the wind they are very attractive (Trans. Roy. Scot. Arb. Soc. xii. pt. 2).

A. sibirica has been planted in several gardens in Denmark, where examples forty years old or more have attained a height of about 40 feet. I have seen very finely developed specimens in Northern Scandinavia at Upsala, and in North-west Russia. Beautiful examples are also to be seen in the Botanic Gardens at Helsingfors (60° 10'), where many seedlings have sprung up around the old trees.

A. subalpina, Engelm. in Amer. Nat. x. 554, and Syn. Amer. Firs, Trans. Acad. St. Louis, 1878, 597. *Pinus lasiocarpa*, Hook. Flor. Bor. Amer. ii. 163. *Abies lasiocarpa*, Nutt. ex Sarg. Forest Trees, 1884, 211. *A. bifolia*, Murr. in Proc. Hort. Soc. Lond. iii. 320, f. 51-56. *Pinus amabilis*, Parl. in DC. Prodr. xvi. 2, 426. *Picea bifolia*, Murr. in Gard. Chron. 1875, 106. *Abies fallax*, hort.

Habitat.—Valley of the Stakhin River, Alaska, in latitude 60° N. (Muir); south through British Columbia, and along the Cascade Moun-

tains to Northern Oregon (Collier); through the Blue Mountains of Oregon and the ranges of Idaho,* Montana, Wyoming, Utah, and Colorado. On the borders of tree vegetation it only forms a shrub.

A tree 80-130 feet in height, with a trunk rarely exceeding 2 feet in diameter; mountain slopes and cañons between 4,000 (British Columbia) and 12,000 (Colorado) feet elevation; generally scattered and rarely forming the prevailing forest growth.

A. umbilicata, new spec. *A. umbellata*, Mayr, Monogr. Abiet. Jap. 1890, 34.

Habitat.—Found only in few places in Japan; the greater number on the top of the Mitsumine-san, in Chichibu-gōri (Musashi), where also *A. homolepis* grows in the Beech region, and towards the top of the mountain, especially on the north side, in mixed forests, often excluding deciduous trees. *A. umbilicata* attains the same height as *A. homolepis*, together with which it grows on the above-mentioned hills, in the province of Musashi, as far as Shinano, leading to Iumonjitōge, and is supposed not to be rare on the neighbouring mountains of Hida and Kai. In Dr. H. Mayr's book it is erroneously called *A. umbellata*.

One young tree only has been planted in Denmark, 1891.

A. Webbiana, Lindl. in Penny Cyclop. n. 7. *Pinus Webbiana*, Wall. Mss. *P. spectabilis*, Lamb. Pin. ed. 2, i. 54, t. 34. *P. tinctoria*, Wall. Cat. *Picea Webbiana*, Loud. Arb. iv. 2344, f. 2251-53. *Abies spectabilis*, Spach, Hist. Vég. Phan. xi. 422. *A. densa*, Griff. Mss. *A. chilrouensis*, hort. *Pinus striata*, Hamilt. Mss.

Habitat.—According to Dr. Brandis, in "Forest Flora," p. 528, it is found in North Afghanistan, between 8,500 and 10,000 feet elevation; in the forests of the Kuram and Hariab districts; in the Himalayas, from the Indus to Bhotan, forming extensive forests—in the North-west without other trees, or in association with the Acer or other leaf-trees, in high regions together with *Betula Bhajpattra*, often with *Picea Morinda* and *Picea excelsa*, and in the Punjab, varying from 6,000 to 12,000 feet. On the Koor its lowest border-line is 10,000 feet. In Jaunsar, Gurhwal, and Kamaon it ranges from 9,000 to 14,000 feet. On the inland mountains of Sikkim and Bhotan *Abies Webbiana* forms—together with *Tsuga Brunoniana* and *Taxus*, Oaks, large Rhododendrons, and small Bamboos—the upper border-line of the Conifer forests, between 10,000 and 14,000 feet.

This is a handsome-growing tree, frequently attaining the height of from 80 to 90 feet, and producing long, aspiring branches, approximating to *A. pectinata*; but it is readily distinguished from that species by its much broader and longer leaves, even in a young state. It was first discovered by Captain W. S. Webb, who gave the following description of the species to Dr. Wallich: "This purple-coned Pine is called Oumar; it attains a height of 80 or 90 feet, with a diameter of the stem near the ground of from 3 to 4 feet. The cones are produced

on the extremity of the shoots. The leaves are about an inch long, of a beautiful light green, having a white stripe in the centre. The wood is used for planes, and even equals, in the texture of its grain and odour, the Bermuda Cedar. The fruit is said to yield, at full growth, an indigo or purple pigment, by expression. The silvery hue of its bark, the beautiful contrast of the leaves with globules of transparent resin, produce in combination one of the most striking objects that can be imagined, and entitle the tree to precedence for ornamental purposes."

Dr. Hooker found it in Sikkim measuring 30 feet in girth. It also forms most dense and extensive forests on the north side of the Shatool Pass, but on the south face it does not flourish. It is called "Chilrow" in the Northern Himalayas; "Oonum," or Purple-coned Fir, and the "Raisalla," or King Pine, in Upper Kamaon and Nepaul.

This is the Black Fir, found so abundantly by Dr. Griffith on the Bhotan Mountains, at an elevation of from 11,000 to 12,500 feet, where it forms a lofty tabular or flat-headed tree, with the foliage of the deepest green on the upper surface, but quite silvery beneath. It is called "Rai-Sulla" (Fragrant Fir) and "Gobrea-Sulla" (Fragrant or Indigo Fir) by the Gorkhalese, on account of an indigo or purple pigment being extracted from the young cones. On the Khoor Mountains the inhabitants call it "Kilounta," which is a Sanscrit compound for "end of the Pine-tree," and denotes the fir-cone, so conspicuous in this species, on account of its beautiful purple or violet colour. In Kooloo, and on the Chumbra range, it is styled "Toss," and forms extensive forests, where, notwithstanding the whiteness of the under surface of its leaves, the general effect of the Himalayan Silver Fir is exceeding dark and gloomy—more even than the Indian Cypress (*Cupressus torulosa*), which from a distance it a good deal resembles; but still the thoroughgoing black Pindrow Fir, with its tall columnar outline and boughs, much less bushy and pendulous, and its longer leaves, must be pronounced the handsomer tree of the two.

Timber white, very soft, and coarse-grained, but full of clear white resin, and a beautiful dye of a lovely violet colour is extracted from the young cones (G. Gordon, "The Pinetum," 1875).

Introduced into Europe in 1822. Seeds had repeatedly been sent by Dr. Wallich to Mr. Lambert and others, but none appear to have vegetated till the date above given, when some plants were raised in the Fulham nursery.

A. Webbiana, I have been told, has developed into a fine tree of about 30 feet in height in a garden in West Zealand.

A. Veitchii, Carr. Conif. ed. 2, 309. *Picea Veitchii*, Lindl. in Gard. Chron. 1861, 23. *Pinus selenolepis*, Parl. in DC. Prodr. xvi. 2, 427. *P. Veitchii*, MacNab, Proc. Roy. Irish Acad. 686. *Abies Eichleri*, Lauche, Berl. Gartenzeit. 1882, s. 63 (*cum ic.*).

Habitat.—Japan, on Ishitzuchi-Yama, on Shikoku, on Mount Susi-

Yama, at from 6,000 to 7,000 feet elevation; also on Nikko, from 6,000 to 8,000 feet elevation. It is not to be found further north than 39°.

Introduced by James Veitch & Son in 1879, through their collector, Mr. Maries.

In the above list of Conifers grown in Denmark it has been found necessary to omit the names of several varieties which, with those mentioned, I have planted during the last twelve years for trial. A great many species and varieties have thus been introduced for the first time in Denmark, and a few years hence I hope to be able to report with some exactitude as to their hardiness &c. in our climate. The Conifers planted have been arranged geographically, and more than 900 forms (that is, species and varieties) have been arranged in this instructive way. It is a method I would recommend to every lover of these ornamental and useful plants, as it affords much food for study to begin with, and, though perhaps entailing more work at first than by adopting the so-called scientific arrangement, the result is much more gratifying.

STATISTICS

OF

CONIFERS IN THE BRITISH ISLANDS.

By Mr. MALCOLM DUNN, F.R.H.S.

THE details of the Conifers in Britain given in the following Tables were collected in connection with the preparation of the paper on "The Value in the British Islands of Introduced Conifers," read at the Conference on Conifers at Chiswick. They contain a large amount of valuable information about the Newer Conifers, with practical remarks upon their treatment in over a hundred different parts of the country, which may be studied with advantage by all who are interested in the prosperity of the woods and forests of the United Kingdom, or in the adornment of the landscape. The following twenty-four Conifers were specially named as species about which it was desirable to get information; and hence, to a certain extent, their predominance in the returns, viz.:—

<i>Abies Albertiana</i>	<i>Pinus austriaca</i>
„ <i>concolor</i>	„ <i>Cembra</i>
„ <i>Douglasii</i>	„ <i>excelsa</i>
„ <i>grandis</i>	„ <i>insignis</i>
„ <i>magnifica</i>	„ <i>Jeffreyi</i>
„ <i>Menziesii</i>	„ <i>Laricio</i>
„ <i>nobilis</i>	„ <i>monticola</i>
„ <i>Nordmanniana</i>	„ <i>ponderosa</i>
<i>Araucaria imbricata</i>	<i>Taxodium sempervirens</i>
<i>Cedrus atlantica</i>	<i>Thuya gigantea</i>
„ <i>Deodara</i>	<i>Thuyopsis borealis</i>
<i>Cupressus Lawsoniana</i>	<i>Wellingtonia gigantea.</i>

The correspondents were also requested to give details of the merits and dimensions of any other Conifers that had proved in a marked degree to be useful or ornamental; with the result that about one hundred other species and varieties are mentioned, and the details concerning them appear in the Tables. The

trees that have been most frequently added are: *Abies cephalonica*, *A. Morinda* (or *A. Smithiana*), *A. orientalis*, *A. Pattoniana* (or *A. Hookeriana*), *A. Pinsapo*, *A. Webbiana*; *Cryptomeria japonica*, *Cupressus macrocarpa*, and *Libocedrus decurrens*. These two lists furnish a good index to the most popular and useful species of introduced coniferous trees; but, of course, they do not apply to the numerous varieties of coniferous shrubs and small trees, many of which are very beautiful and highly popular.

The statistical Tables for England, Scotland, and Ireland are arranged in separate lists for the respective countries, the counties and places being given in the usual alphabetical order. In a Table at the end a list is given of every species and variety mentioned in the returns, with the names of the place and county where the largest specimen is growing, the greatest height and girth of stem at five feet up, and the number of times it is recorded in the returns.

ENGLAND.

I.—STATISTICS OF CONIFERS IN ENGLAND.

BUCKINGHAMSHIRE.

DROPMORE. LADY FORTESCUE.

Altitude, 100 feet. Soil, light loam; subsoil, gravel.

Correspondent: Mr. CHARLES HERRIN, The Gardens, Dropmore, Maidenhead.

Botanical Name	Age.	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	61	120	11 0	64	Sheldt.	Healthy and vigorous.
<i>Araucaria imbricata</i> ...	61	68½	8 0	38	"	Vigorous; grand.
<i>Pinus insignis</i>	52	90	11 0	—	"	" "
" "	52	79	12 0	—	"	" "

GENERAL REMARKS.—The large Douglas Fir has lost several branches by heavy snowstorms breaking them down in recent years; but it is in perfect health and full of vigour, and it has made unusually strong growths this season. The leader, however, being now too high to derive shelter from the other trees, suffers considerably from the wind, and is not in a very flourishing condition. The large *Araucaria* is in grand health, with the branches sweeping the ground. The examples of *Pinus insignis* are very fine trees, in vigorous health.

CAMBRIDGESHIRE.

PAMPISFORD HALL. Colonel HAMOND.

Altitude, 120 feet. Soil, loam; subsoil, chalk.

Correspondent: Mr. JAMES MORLEY, Westfield, Little Shelford.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	14	16	1 0	9	S.W.	Healthy; fine.
" <i>amabilis</i>	14	12	0 9	12	W.	" "
" <i>cephalonica</i>	35	45	4 0	40	N.W.	" "
" <i>concolor</i>	22	25	2 0	23	S.	" "
" <i>Douglasii</i>	22	35	2 6	12	"	" "
" <i>grandis</i>	20	30	2 0	33	"	" "
" <i>magnifica</i>	12	13	1 0	12	N.W.	Gets slightly browned.
" <i>Menziesii</i>	14	16	1 0	16	S.W.	Vigorous; fine.
" <i>nobilis</i>	16	14	1 0	12	E.	" "
" <i>Nordmanniana</i> ...	16	25	2 0	18	S.W.	Fast grower.
" <i>numidica</i>	15	20	1 0	12	N.W.	Very beautiful.
" <i>Pinsapo</i>	46	62	9 0	50	S.E.	Splendid.
<i>Araucaria imbricata</i> ...	22	12	1 0	10	S.	Grows slowly.
<i>Cedrus atlantica</i>	50	50	5 0	50	N.E.	Slightly browned.
" <i>Deodara</i>	35	40	2 6	34	N.W.	Much affected by frost.
<i>Cupressus Lawsoniana</i>	27	30	1 6	16	N.	Healthy; vigorous.
<i>Libocedrus decurrens</i> ...	26	40	2 6	4	"	Splendid; upright.
<i>Pinus austriaca</i>	40	60	4 6	26	S.W.	Healthy; vigorous.
" <i>Banksiana</i>	25	26	1 2	9	N.E.	Very hardy.
" <i>calabrica</i>	35	60	6 0	40	W.	Most beautiful.
" <i>Cembra</i>	20	16	1 0	12	N.W.	Healthy; slow grower.
" <i>excelsa</i>	40	45	3 0	35	"	Occasionally frosted.
" <i>insignis</i>	9	12	0 9	6	"	" "
" <i>Jeffreyi</i>	25	26	1 6	16	E.	Vigorous.
" <i>Laricio</i>	40	65	5 0	40	N.W.	Free growing.
" <i>macrocarpa</i>	20	25	2 6	16	E.	Robust; cones freely.
" <i>monticola</i>	20	30	1 6	12	S.W.	Fast growing; beautiful.
" <i>ponderosa</i>	20	20	1 0	12	S.	Robust and healthy.
" <i>Sabiniana</i>	20	24	2 6	16	S.W.	" "
<i>Taxodium sempervirens</i>	40	50	6 0	35	N.	Often injured by frost.
" <i>variegata</i>	14	16	1 10	10	"	Very beautiful.
<i>Thuya gigantea</i>	25	35	1 9	20	S.W.	Vigorous; free.
<i>Thuyopsis borealis</i>	26	24	2 0	16	N.W.	Very handsome.
" <i>variegata</i>	22	22	1 0	12	"	Beautiful.
<i>Wellingtonia gigantea</i>	35	60	4 0	40	S.E.	Most beautiful.

CARMARTHENSHIRE.

GOLDEN GROVE. VISCOUNT EMLYN.

Altitude, 100 to 300 feet. Soil, heavy loam and peaty; subsoil, Silurian formation.

Correspondent: Mr. JOHN HILL, The Gardens, Golden Grove, Llandilo.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	22	52	6 5	27	N.W.	Beautiful spec.; branches sweeping the ground.
„ <i>concolor</i>	20	60	5 9	18	W.	Very well sheltered; handsome specimen.
„ <i>Douglasii</i>	22	62	7 0	37	„	Branches sweeping grd.; beautiful specimen.
„ <i>grandis</i>	22	60	7 8	39	„	Well "sheltered; " ornamental.
„ <i>Hookeriana</i>	22	15	1 6	16	E.	
„ <i>Menziesii</i>	22	45	6 2	23	W.	Fine specimen; branches sweeping the ground.
„ <i>Morinda</i>	22	40	5 8	25	„	Very handsome tree; branches drooping to gd.
„ <i>nobilis</i>	22	44	6 6	24	N.	A grafted tree; well-branched to ground.
„ <i>Nordmanniana</i> ...	22	35	5 0	24	„	Handsome; and branches sweeping ground.
<i>Araucaria imbricata</i> ...	18	32	2 4	15	Sheldt.	Beautiful; fast-growing tree in perfect shelter.
<i>Athrotaxis Doniana</i> ...	20	10	—	—	„	Very ornamental; perfect shelter.
„ <i>imbricata</i> ...	20	10	—	—	„	
<i>Cedrus atlantica</i>	22	40	5 0	24	„	Beautiful spec.; branches sweeping ground.
„ <i>Deodara</i>	22	38	7 0	35	N.W.	Very "ornamental."
<i>Cryptomeria elegans</i> ...	20	20	1 4	12	N.	Beautiful tree; accidentally lost its leader.
„ <i>japonica</i> ...	22	30	6 3	21	„	Very fine specimen.
<i>Cupressus Lawsoniana</i>	22	31	4 3	12	„	Makes little "progress; too exposed.
<i>Pinus austriaca</i>	18	30	2 7	18	Sheldt.	Has been frosted, but now in vigorous health.
„ <i>Cembra</i>	22	30	3 8	17	N.	Vigorous and healthy.
„ <i>excelsa</i>	38	15	2 0	10	Fully exp'd.	Vigorous; slight shelter.
„ <i>insignis</i>	22	35	7 0	31	N.W.	Vigorous and healthy.
„ <i>Laricio</i>	18	35	6 5	26	W.	" " "
„ <i>monticola</i>	22	36	4 5	16	N.	
„ <i>Mugho</i>	18	20	1 3	15	Sheldt.	
„ <i>ponderosa</i>	18	30	1 4	12	Fully Sheldt.	
<i>Sciadopitys verticillata</i>	18	6	0 8	4	„	Very interesting and neat.
<i>Taxodium sempervirens</i>	22	48	5 0	18	N.	Leader sometimes frosted.
<i>Thuya gigantea</i>	22	50	5 9	19	„	Moved to presentsite when 30ft. high; mst. vig. grwr.
<i>Thuyopsis borealis</i>	22	30	3 4	12	„	A hardy and most vig. tree.
<i>Wellingtonia gigantea</i>	22	53	10 5	30	N.W.	Slight shelter on west; vig.; very handsome.

GENERAL REMARKS.—All the Conifers named in the above list are growing here in vigorous health (except *Pinus excelsa*, which is exposed to every wind that blows, and suffers in consequence), and finely feathered to the ground with branches, the picture of luxuriant growth. Besides those in the list, many kinds of beautiful ornamental Conifers have been planted, including numerous fine varieties of *Retinosporas*, *Junipers*, *Thuyas*, *Cypresses*, and *Yews*, which all thrive well in our humid climate, the average rainfall being nearly 60 inches in the year, and the number of wet days 150, often more! As an instance of the rapid and vigorous growth made by some of our Conifers, it may be mentioned that a tree of *Abies nobilis* raised here from seed 22 years ago, is now 48 feet high; 6 feet 11 inches in girth at 5 feet up; with a spread of branches 26 feet in diameter; growing in a heavy loam.

Lest the description of the soil given in the table may mislead (although correct), it may be as well to state that in addition to the natural soil, a special preparation was made for each individual tree, by taking off the surface loam about ten inches deep and ten feet in diameter, and adding to it about one-fourth of rich peat and a substance obtained from the garden furnaces. This substance, before it is used for fuel, is made from about two-thirds of coal, reduced very fine in the process of digging the anthracite coal, and one-third of clay, properly mixed and dried for burning. Before mixing it with the loam and peat, it is passed through a fine sieve, and then the whole is thoroughly mixed and returned into the circular hole—having previously broken up the bottom, composed of the upper strata of the Silurian rock—and the compost made very solid by firm treading. In this mixture the Conifers make an excellent start, and grow with great vigour; but doubtless they have now taken full possession of the natural soil, and they are thriving with undiminished vigour.

CARNARVONSHIRE.

PENRHYN CASTLE. LORD PENRHYN.

Correspondent: MR. WALTER SPEED, The Gardens, Penrhyn Castle, Bangor.

Botanical Name	Age	Height	Diameter of Branches	Remarks
	Years	Feet	Feet	
<i>Abies cephalonica</i>	—	60	14	Fine healthy tree.
„ <i>Douglasii</i>	—	60	34	Very fine specimen.
„ <i>grandis</i>	40	70	15	„ „
„ <i>Menziesii</i>	—	72	14	„ „
„ <i>nobilis</i>	—	70	19	„ „
„ <i>Nordmanniana</i>	—	70	21	Fine specimen.
„ <i>orientalis</i>	40	58	13	„ „
„ <i>Pinsapo</i>	—	40	13	„ „
„ <i>Smithiana</i>	40	54	13	Very fine specimen.
<i>Araucaria imbricata</i>	—	40	12	„ „
<i>Cedrus atlantica</i>	—	52	16	Good specimen.
„ <i>Deodara</i>	—	50	15	„ „
<i>Cupressus Lawsoniana</i>	—	42	9	Very good specimen.
<i>Pinus austriaca</i>	—	40	14	Good healthy specimen.
„ <i>Cembra</i>	—	35	11	„ „
„ <i>Laricio</i>	48	60	15	„ „
<i>Taxodium sempervirens</i>	—	72	35	Very fine „
<i>Thuyopsis borealis</i>	—	35	12	„ „
<i>Wellingtonia gigantea</i>	35	70	15	„ „

GENERAL REMARKS.—The particulars given in the table refer to some of the best specimens of these Conifers grown at Penrhyn, where in general they are very healthy and vigorous.

CORNWALL.

BOCONNOC. Colonel FORTESCUE.

Altitude, 200 feet. Soil, loam; subsoil, loamy spar.

Correspondent: Mr. CHARLES LEE, The Gardens, Boconnoc, Lostwithiel.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies bracteata</i>	30	49	4 6	—	Partly Sheldt.	Very straight and slender; keeps its col. well; fine.
„ <i>cephalonica</i>	35	73	9 6	—	N.E.	Very fine spec.; thriving.
„ <i>Menziesii</i>	48	85	12 0	42	„	Handsome when young.
„ <i>Nordmanniana</i> ...	30	48	4 0	14	„	Compact; very handsome.
<i>Cedrus Deodara</i>	38	50	6 1	—	Sheldt.	Gen. not thriving well.
<i>Cryptomeria Lobbi</i> ...	30	64	7 0	—	„	Very handsome; fine spec.
<i>Pinus austriaca</i>	44	65	7 0	—	„	Requires shelt. in this local.
„ <i>insignis</i>	48	68	13 0	—	„	Vig.; not symmetrical.
„ <i>Laricio</i>	40	79	5 9	—	„	Vig.; rough; gd. timb. tree.
<i>Taxodium sempervirens</i>	40	75	13 0	—	„	Makes fine spec. in shelt.
<i>Thuyopsis borealis</i>	30	36	4 6	24	Open.	Handsome; stands expos.
„ <i>dolabrata</i> ...	30	25	2 0	17	E.	Of free hardy growth; distinct and beautiful.

GENERAL REMARKS.—The Conifers mentioned above are doing well here; and such tender species as *Abies bracteata* and *Pinus insignis* grow with great vigour. *Taxodium sempervirens* grows vigorously in sheltered places, and forms a very fine tree. *Cryptomeria Lobbi*, and *Thuyopsis borealis* and *T. dolabrata* are also very graceful and distinct Conifers and grow here with great freedom.

SCORRIER. Mrs. G. WILLIAMS.

Altitude, 80 feet. Soil, light loam; subsoil, rocky.

Correspondent: Mr. HENRY HUTCHISON, The Gardens, Scorrier House, Scorrier.

Botanical Name	Age	Height	Girth at 5ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	40	40	4 6	32	S.E.	Very healthy and thriving.
„ <i>nobilis</i> ..	—	24	2 0	20	E.	Not much planted here.
<i>Araucaria imbricata</i> ...	40	42	6 3	45	S.	Fine specimen.
<i>Cedrus atlantica</i>	—	36	6 0	43	„	„
„ <i>Deodara</i>	—	36	5 6	33	E.	„
<i>Cryptomeria japonica</i> ...	—	40	5 6	32	W.	Thriving; fine specimen.
<i>Cupressus Lawsoniana</i>	—	45	—	14	N.E.	„
<i>Pinus austriaca</i>	—	40	4 6	20	W.	Good specimen.
„ <i>excelsa</i>	30	34	3 0	26	N.	„
„ <i>insignis</i>	40	60	10 0	48	S.E.	Branched to the ground; a handsome tree.
<i>Taxodium sempervirens</i>	—	46	7 6	24	„	Requires shelt. from wind.
<i>Thuyopsis borealis</i>	—	26	—	12	„	Fine bushes; graceful habit.
<i>Wellingtonia gigantea</i>	35	52	9 0	23	„	Not to be recommended.

GENERAL REMARKS.—In this place Conifers grow freely and make very fine specimens when sheltered from the fierce winds that sweep over us. *Abies Smithiana* and *A. Webbiana* are good in shelter; and so are *Cryptomeria japonica* and *Taxodium sempervirens*.

MENABILLY. J. RASHLEIGH, Esq.

Correspondent: Mr. W. BENNETT, The Gardens, Menabilly, Fowey.

GENERAL REMARKS.—I have sent two branches of Mexican Pines: one is labelled "*Pinus oocarpa* or *Russelliana*," as Mr. Rashleigh is not quite sure which it is, but it was sent hither under the name of *Russelliana*; the other is *Pinus Montezumæ*.

P. oocarpa or *Russelliana* is a tree 21 feet high, and covers an area 69 feet in circumference with its irregular pendulous branches, some of which are resting on the ground. It bore three cones this season, and although there were male blossoms on the tree at the same time, they withered and dropped off.

P. Montezumæ is 16 feet high and covers an area of 66 feet. It is bearing cones, which are about 4 inches long and 2 inches in diameter at the base, slightly incurved at the point. These trees have been growing here for about eighteen years.

We have also a number of young plants of *Pinus Montezumæ Lindleyana*—about four years old, raised from seed received from the British Consul at Mexico; they are from 1 to 4 feet in height, and some of them have made 1 foot 7 inches growth this season. We do not protect these during the winter months, as we find the more they are exposed the freer they grow; in fact, several of them are planted on an exposed place, with a north-east aspect.

Pinus monticola is 21 feet high, and bears cones freely.

Pinus parviflora, 8 feet high, has been planted here about four years, and has borne cones the last three seasons; it is looking well.

Picea Pindrow, 25 feet high, covering 50 feet area, bore cones last season.

Abies ajanensis, 25 feet high, covering an area of 44 feet.

Picea grandis, 30 feet high, planted about eleven years (it was about one foot high when planted), covering an area of 55 feet.

Picea lasiocarpa is 27 feet high and 54 feet in circumference of branches.

Picea religiosa is 24 feet high. This tree felt the severity of last winter, but is now looking fairly well.

Retinospora leptoclada, about 4 feet high, and has borne cones for some years.

All the above are growing in a deep loamy soil, about 140 feet above sea level in a north-by-east aspect.

Pinus insignis, sent hither by the Horticultural Society under the name of *P. radiata*, and planted by J. Rashleigh, Esq., in the year 1843, is now 61 feet high and 10 feet 6 inches in girth at 3 feet from the ground.

Pinus insignis, sent hither and planted by J. Rashleigh, Esq., in 1846, is 61 feet high, and 11½ feet in girth at 3 feet from the ground.

The Pines we find grow fastest here are *Pinus insignis* and *P. muricata*; and the two fastest-growing Firs are *Picea* or *Abies grandis* and *A. Douglasii*.

Athrotaxis lawifolia, 14 feet high and covering an area of 21 feet, is planted on a slight mound in peaty loam; this has fruited for several years.

I have sent these notes to give an idea of the growth which some of these plants have made in a few years.

CARCLEW. Colonel TREMAYNE.

Correspondent: Mr. J. SIMMONS, Carclew, Perranarworthal.

Botanical Name	Height	Girth 3 feet from ground		Spread of Branches
		Ft.	In.	
<i>Abies Albertiana</i>	68	5	5	36
„ <i>cephalonica</i>	59	6	0	40
„ <i>Douglasii</i>	84	9	10	55
„ <i>firma</i>	45	2	8	—
„ <i>Menziesii</i>	75	6	0	38
„ <i>Morinda</i>	80	7	7	32
„ <i>Nordmanniana</i>	50	3	9	26
„ <i>polita</i>	13	—	—	—
<i>Cedrus Deodara</i>	65	4	0	45
<i>Cryptomeria japonica</i>	55	6	0	24
<i>Cupressus Lambertiana</i>	82	10	7	60
„ <i>macrocarpa</i>	56	4	0	—
<i>Larix Kämpferi</i>	30	3	7	30
<i>Pinus insignis</i>	80	10	0	45
„ <i>patula</i>	45	6	0	50
<i>Retinospora obtusa</i>	23	2	7	—
<i>Salisburia adiantifolia</i>	48	3	8	—
<i>Taxodium distichum</i>	41	3	9	—
„ <i>sempervirens</i>	69	10	2	38
<i>Thuopsis dolabrata</i>	14	—	—	—
„ „ <i>variegata</i>	17	—	—	—

DEVONSHIRE.

BICTON. The Hon. MARK ROLLE.

Correspondent: The Hon. MARK ROLLE, Bicton.

Botanical Name	Height	Girth at 5 ft. up	General Remarks
	Ft.	Inches	
<i>Abies Menziesii</i>	11	7 $\frac{1}{2}$	The <i>Araucaria</i> avenue, planted in 1842-3, contains 50 trees; the largest of these, at 4 ft. from the ground, girths 7 ft. 5 in. These trees vary much in form of growth, some feathering to the ground, while others have bare stems 18 to 20 ft. up. One specimen bears cones as well as male catkins.
„ <i>Douglasii</i>	11	4 $\frac{3}{4}$	
„ <i>Morinda</i>	9	3	
<i>Cedrus Deodara</i>	10	3	
<i>Cupressus macrocarpa</i>	10	10	
<i>Picea cephalonica</i>	13	4 $\frac{1}{2}$	
„ <i>nobilis</i>	7	9 $\frac{1}{2}$	
„ <i>Webbiana</i>	7	2	
<i>Pinus insignis</i>	15	1 $\frac{1}{2}$	
<i>Taxodium sempervirens</i> ...	12	7 $\frac{1}{2}$	

POWDERHAM CASTLE. EARL OF DEVON.

Correspondent: Mr. D. C. POWELL, The Gardens, Powderham, Exeter.

GENERAL REMARKS.—I forward specimens bearing cones of the following Conifers: *Abies Douglasii*, planted 1847; 106 feet high; girth of trunk at 3 feet from ground, 9 feet. *Picea cephalonica*, 77 feet; girth, 11 feet 2 inches. *Picea Fraseri*, 72 feet; girth, 9 feet 7 inches. *Cedrus Deodara*, *Cephalotaxus drupacea*, *Cryptomeria japonica*, *Cupressus Goveniana*, *Cupressus macrocarpa*, *Picea Nordmanniana*, *Pinus excelsa*, *Thuopsis dolabrata*, *Wellingtonia gigantea*. The cones of *Picea nobilis* have been destroyed by squirrels.

DERBYSHIRE.

BRETBY PARK. EARL OF CARNARVON.

Altitude, 250 to 360 feet. Soil, loam; subsoil, gravel and clay.

Correspondent: Mr. THOMAS DOW, Forester, Bretby Estates, Burton-on-Trent.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies nobilis</i>	31	42	2 10	21	Sheldt.	Fine healthy specimen.
<i>Araucaria imbricata</i> ...	40	30	2 10	17	S.	A fine thriving tree.
<i>Cedrus atlantica</i> .....	...	60	9 0	51	„	One of about 20; all thriving well.
„ <i>Deodara</i>	31	26	2 5	10	S.W.	Not a healthy specimen.
„ <i>Libani</i>	215	82	16 2	85	S.	Very healthy; planted in 1676.
<i>Pinus austriaca</i>	45	52	7 0	33	W.	Fine spec.; near the Hall.
„ <i>Laricio</i>	18	16	1 6	6	Sheldt.	A fine promising Conifer.
<i>Wellingtonia gigantea</i> ...	31	40	5 2	17	S.	Fine healthy specimen.

GENERAL REMARKS.—The most notable tree in the above list is the grand old Cedar of Lebanon, which is believed to be the oldest Cedar now growing in England, having been planted at Bretby in 1676. It stands on a south sloping spot, about 360 feet above sea-level, and is still healthy and vigorous, although a branch dies off occasionally. The soil is a deep black loam of good quality, resting on sandy clay, which seems to suit the wants of the Cedar admirably. The height of the stem to the first branch is 11 feet, with an almost uniform girth of 16 feet 2 inches. It then swells out and divides at 15 feet up into three main stems, the middle one rising straight from the lower bole, and the other two shooting up alongside of it nearly perpendicular.

GLOUCESTERSHIRE.

TORTWORTH. EARL DUCIE.

Correspondent: Mr. THOMAS SHINGLES, The Gardens, Tortworth, Falfield.

Altitude, 240 feet. Soil, sandy; subsoil, old red sandstone.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies bracteata</i>	37	43	4 9	30	N.W.	One of the first sent out.
„ <i>nobilis</i>	36	78	7 6	36	N.E.	
<i>Araucaria imbricata</i> ...	49	50	6 5	36	W.	In a shady place.
<i>Larix Kämpferi</i>	35	25	2 6	21	N.	
<i>Prumnopitys elegans</i> ...	25	17	—	17	S.E.	
<i>Taxodium sempervirens</i>	36	73	8 9	34	S.	
<i>Torreya myristica</i>	30	21	2 10	23	Open	
<i>Wellingtonia gigantea</i> .	35	67	10 0	29	Open	

HUNTINGDONSHIRE.

ORTON LONGUEVILLE. MARQUIS OF HUNTLY.

Altitude, 54 feet. Soil, fertile loam; subsoil, gravel.

Correspondent: Mr. A. HARDING, The Gardens, Orton Hall, Peterborough.

Botanical Name	Height	Remarks
	Feet	
<i>Abies concolor</i>	60	One of our handsomest trees.
„ <i>Douglasii</i>	65	Does well in damp places.
„ <i>grandis</i>	65	Fast grower; fine tree.
„ <i>magnifica</i>	20	Distinct and beautiful.
„ <i>Morinda</i>	58	Fine graceful tree.
„ <i>nobilis</i>	43	Does not thrive well.
„ <i>Nordmanniana</i>	58	One of the best.
„ <i>pectinata</i>	85	Fine specimens.
<i>Araucaria imbricata</i>	36	Does not thrive well.
<i>Cedrus atlantica</i>	60	Very handsome tree; cones freely.
„ <i>Deodara</i>	46	Handsome tree; with fine stem.
<i>Cupressus Lawsoniana</i>	42	Good specimens.
<i>Libocedrus decurrens</i>	50	Very fine upright tree.
<i>Pinus austriaca</i>	45	Good specimens.
„ <i>Cembra</i>	62	Two fine specimens.
„ <i>excelsa</i>	69	A fine upright specimen.
„ <i>Jeffreyi</i>	46	Growing freely.
„ <i>Laricio</i>	60	„ „
„ <i>monticola</i>	58	Fine ornamental tree.
„ <i>ponderosa</i>	63	„ „
<i>Salisburia adiantifolia</i>	35	An attractive tree.
<i>Taxodium sempervirens</i>	68	Very fine; stem girths 15 ft. at 1 ft. up.
<i>Thuja gigantea</i>	55	One of the best; very handsome.
<i>Thuyopsis borealis</i>	40	Grows well; beautiful tree.
<i>Wellingtonia gigantea</i>	70	Very fine; handsome tree.

GENERAL REMARKS.—The Conifers named in the list are all well grown specimens, with good stems well furnished with branches. The collection here contains many other species of coniferous trees and bushes, most of which are doing well in our fertile soil. We have in all about 300 trees of *Wellingtonia*, ranging from 45 to 70 feet high; and the fine avenue of them here is considered one of the best in Britain, many of the trees being perfect specimens.

KENT.

LINTON PARK. F. S. W. CORNWALLIS, Esq.

Altitude, 300 feet. Soil, stiff loam; subsoil, Kentish rag.

Correspondent: Mr. JOHN MCKENZIE, The Gardens, Linton Park, Maidstone.

Botanical Name.	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	68	4 3	32	Sheld.	Very ornamental.
„ <i>cephalonica</i>	45	70	9 4	65	S.	A grand specimen; full of cones.
„ <i>concolor</i>	30	64	8 7	32	„	A grand tree.
„ <i>nobilis</i>	45	72	6 4	35	Sheld.	Quite a picture.
„ <i>Pinsapo</i>	40	60	6 6	42	„	Fine ornamental tree.
„ <i>Smithiana</i>	45	71	8 0	47	„	Very hardy and graceful.
<i>Araucaria imbricata</i> ...	45	47	4 9	—	„	Lost branches to 10 ft. up.
<i>Cedrus Deodara</i>	50	60	9 6	52	„	A feature in the grounds.
<i>Cupressus Lawsoniana</i>	30	47	4 5	17	„	A dense green column.
„ <i>macrocarpa</i>	37	61	8 0	43	„	Always in good condition.
<i>Pinus austriaca</i>	50	74	8 0	56	„	Bare stem to 14 ft. up.
„ <i>Cembra</i>	30	68	5 0	12	„	Very uniform trees.
„ <i>excelsa</i>	48	60	8 0	70	„	Splendid tree.
„ <i>insignis</i>	45	62	10 0	52	„	Suffered badly from the severities of last winter.
„ <i>macrocarpa</i>	25	44	4 6	24	S.	Very fine tree.
„ <i>ponderosa</i>	36	63	9 2	—	„	Bare stem to 20 ft. up.
<i>Taxodium sempervirens</i>	47	60	11 0	48	„	Lost 3 ft. of top last winter.
<i>Thuya gigantea</i>	30	65	6 0	19	Sheld.	In perfection.
<i>Wellingtonia gigantea</i>	30	72	10 6	33	„	Very symmetrical.

GENERAL REMARKS.—Every care has been exercised to have the dimensions of the above specimens of Conifers taken as accurately as possible, so that the figures may be relied upon. All the trees are grown on a southern slope, well sheltered, but generally open to the south. The soil is a strong heavy loam, resting on the Kentish rag, which forms a thorough natural drainage.

The last severe winter, when we had two feet of snow in Kent, with the thermometer down about zero, severely tested the hardiness and suitability, or otherwise, of the various kinds of Conifers, and those which have survived it may be considered tolerably hardy in ordinary seasons. Here, *Pinus insignis* suffered severely in all its stages; the oldest trees having huge branches torn off and twisted about in the most curious way by the weight of snow and the force of the gale, while the younger trees looked as if they had been severely singed all over, their foliage was so browned. They have mostly made a fair effort to grow during the past summer, but I am afraid few, if any, of them will ever wholly recover. Fine specimens of *Abies Webbiana* have had their tops killed for several feet down; and the tops of *Taxodium sempervirens* have been killed back 2 to 3 feet. The Weymouth Pine has also suffered severely, and the foliage appears as if scorched. *Cryptomeria elegans* is very apt to lose its branches by the weight of snow lodging upon them, and our finest specimen was snapped clean off in the middle during a heavy snowfall. We saved many fine specimens by going round with long poles and shaking off the snow before it accumulated to a great weight upon them; but the snow at times is like a thief in the night—it comes without warning! *Pinus excelsa*, with its widespreading head, got much broken by the weight of snow; and *P. ponderosa* loses a limb or two with almost every snowstorm. The erect-growing Biotas, Junipers, and Thuyas are very liable to damage from a snowstorm,

as the weight of snow lodging among the branches bends them over, and eventually splits them off. All the following came through last winter without the loss of a twig from snow, frost, or wind:—*Abies Albertiana*, *A. canadensis*, *A. cephalonica*, *A. lasiocarpa*, *A. Nordmanniana*, *A. orientalis*, *A. Pinsapo*, *A. Smithiana*, *Cryptomeria japonica*, *Cupressus Lawsoniana*, *C. macrocarpa*, *C. nuthkaensis*, *Pinus Cembra*, *Retinospora pisifera* and all others, *Thuja gigantea*, and *Thuyopsis dolabrata*. *Wellingtonia gigantea* never loses a branch from severe weather, but it sometimes loses its young sappy leading shoot if a gale occurs while it is growing. It does not appear to be a tree that will last many years in a well furnished condition. They are growing here as an avenue, as groups, and as single specimens, and all of them are showing a tendency to lose their lower branches. I am afraid our soil is not deep enough nor our hills high enough, and our rainfall is not great enough, to suit the *Wellingtonia* and grow it in perfection to maturity.

LINCOLNSHIRE.

REVESBY ABBEY. Right Hon. EDWARD STANHOPE.

Altitude, 130 feet. Soil, loam; subsoil, chalk and red sand.

Correspondent: Mr. JAMES ALEXANDER, The Gardens, Revesby Abbey, Boston.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	28	2 2	18	S.E.	Healthy; nice tree.
„ <i>cephalonica</i>	43	45	6 3	33	„	A fine specimen.
„ <i>Douglasii</i>	43	62	7 1	30	„	Healthy; very dark green.
„ <i>grandis</i>	43	70	6 6	32	„	Vigorous and very healthy.
„ <i>magnifica</i>	36	40	5 0	15	„	Beautiful specimen.
„ <i>nobilis</i>	40	46	3 4	18	„	Doing fairly well.
„ <i>Nordmanniana</i> ...	40	50	4 0	30	„	„
„ <i>Pinsapo</i>	43	49	6 6	25	„	Healthy and thriving.
<i>Araucaria imbricata</i> ...	40	40	4 2	25	„	Fine spec.; bearing cones.
<i>Cedrus atlantica</i>	43	52	6 0	25	„	Healthy and thriving.
„ <i>Deodara</i>	43	50	6 6	30	„	„
„ <i>Libani</i>	43	45	9 6	33	„	Healthy, bearing cones.
<i>Cryptomeria elegans</i> ...	30	20	1 10	8	„	Healthy and thriving.
„ <i>japonica</i> ...	40	37	5 3	20	„	„
<i>Cupressus Lawsoniana</i>	30	25	2 1	12	„	„
<i>Libocedrus decurrens</i> ...	40	36	4 0	9	„	„
<i>Pinus austriaca</i>	40	45	7 3	35	„	„
„ <i>Cembra</i>	40	50	3 6	14	„	„
„ <i>excelsa</i>	40	44	6 6	30	„	„
„ <i>insignis</i>	40	52	6 3	20	„	„
„ <i>Jeffreyi</i>	36	48	6 8	36	„	„
„ <i>Lambertiana</i>	43	50	6 8	34	„	„
„ <i>Laricio</i>	43	50	4 0	18	„	„
„ <i>monticola</i>	43	56	4 4	18	„	„
„ <i>ponderosa</i>	43	48	4 2	12	„	„
„ <i>Strobus</i>	43	50	5 0	25	„	„
„ <i>taurica</i>	43	45	7 6	29	„	Healthy, very branchy.
<i>Taxodium distichum</i> ...	40	27	3 8	20	„	Healthy; pretty tree.
„ <i>sempervirens</i>	43	63	9 6	35	„	Fine thriving specimen.
<i>Thuja gigantea</i>	36	46	3 3	12	„	Useful tree for covers.
<i>Thuyopsis borealis</i>	36	40	2 6	20	„	Beautiful tree; very hardy.
<i>Wellingtonia gigantea</i>	34	65	8 8	18	„	Fine healthy specimens.

GENERAL REMARKS.—The finest of the above trees were mostly planted between 1848 and 1851, and on the whole have thriven well in the interval. Nearly all hardy varieties of Conifers are grown in more or less numbers; Cypresses, Thuias, and Junipers thriving well, and attaining a considerable height. Variegated Cypresses, Retinosporas, and Yews grow well and assume rich colours, and the dark-green erect variety of Lawson's Cypress is very effective among them. *Thuypsis dolabrata* is another species that does remarkably well, and is much admired.

NORTHUMBERLAND.

HOWICK HALL. EARL GREY.

Altitude, 80 to 130 feet. Soil, stiff loam; subsoil, clay.

Correspondent: Mr. DAVID INGLIS, The Gardens, Howick Hall, Lesbury.

Botanical Name	Age	Height	Girth at 5 ft. up			Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft.	In.	Feet			
<i>Abies Douglasii</i>	45	60	7	4	51		S.	Thriving well; fine tree.
„ <i>Menziesii</i>	58	90	9	0	60		„	Very fine specimen.
„ <i>Morinda</i>	45	56	6	2	30		„	„ „ „
„ <i>nobilis</i>	20	30	2	0	12		„	Moderate growth.
„ <i>Nordmanniana</i> ...	25	45	4	0	18		„	Beautiful specimens.
„ <i>Pinsapo</i>	20	30	2	3	15		„	Doing well; nice tree.
„ <i>Webbiana</i>	50	51	8	0	36		„	Fine specimen.
<i>Araucaria imbricata</i>	35	39	4	2	21		„	Beautiful; bearing cones.
<i>Cedrus Deodara</i>	40	48	6	0	30		„	Fine specimen.
„ <i>Libani</i>	70	51	12	0	63	Open	„	Grand; girth at 2 ft. up.
<i>Cupressus Lawsoniana</i> ...	25	28	2	8	12		„	Fine specimen.
„ <i>macrocarpa</i> ...	35	48	5	4	24		„	„ „ „
<i>Pinus Cembra</i>	40	45	9	0	22		„	Not very thriving.
„ <i>Jeffreyi</i>	35	45	6	1	21		S.	Doing well.
„ <i>ponderosa</i>	35	36	4	2	18		„	„ „ „
<i>Taxodium sempervirens</i>	35	47	4	0	20		„	Not thriving well.
<i>Wellingtonia gigantea</i> ...	34	60	9	0	12		„	Fine specimen.

GENERAL REMARKS.—Some of the finest specimens of the Conifers here are growing within a quarter of a mile of the German Ocean, and about 80 feet above it. Among others thriving well in such near proximity to the sea, and only moderately sheltered, are *Abies Douglasii*, *A. Menziesii*, *A. Nordmanniana*, *A. Webbiana*, *Araucaria imbricata*, *Cedrus Deodara*, *Cupressus Lawsoniana*, and *C. macrocarpa*. Farther inland, in the grounds and policies, there are many fine healthy specimens, but few are beyond a mile from the sea, or over 130 feet above it.

PEMBROKESHIRE.

STACKPOLE COURT. EARL OF CAWDOR.

Altitude, 60 feet. Soil, loam; subsoil, limestone formation.

Correspondent : Mr. W. FISHER, The Gardens, Stackpole Court, Pembroke.

Botanical Name	Age	Height	Girth at 5ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	35	56	6 5	18	S.W.	Thriving specimen.
„ <i>Nordmanniana</i> ...	20	30	2 11	14	„	Free growing & healthy.
<i>Cupressus macrocarpa</i>	25	36	4 4	18	„	„
<i>Pinus insignis</i>	20	25	4 2	—	„	„
<i>Taxodium sempervirens</i>	35	52	8 9	—	„	„
<i>Wellingtonia gigantea</i>	30	60	8 6	16	„	A fine healthy tree.

SHROPSHIRE.

CHETWYND PARK. J. C. B. BOROUGH, Esq.

Altitude, 360 to 550 feet. Soil, light loam; subsoil, gravel, and clay.

Correspondent : Mr. N. SHERWOOD, The Gardens, Chetwynd Park, Newport.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	30	54	4 3	27	Open	Succeeds well; best in shelter.
„ <i>nobilis</i>	36	32	4 0	21	N.E.	Not thriving too well.
„ <i>Nordmanniana</i> ...	40	65	5 6	27	„	Thriving splendidly.
<i>Cedrus atlantica</i>	30	45	4 6	24	Open	Thriving well.
<i>Cupressus Lawsoniana</i>	34	36	—	18	N.E.	A grand specimen.
<i>Pinus austriaca</i>	35	40	—	—	Open	Fine for making cover.
„ <i>excelsa</i>	30	40	—	30	S.W.	Thrives well.
<i>Thuopsis borealis</i>	30	38	—	22	Open	Makes a grand specimen.
<i>Wellingtonia gigantea</i>	34	65	8 6	20	N.E.	Thriving; fine specimen.

GENERAL REMARKS.—We have not a very large collection of Conifers, but among the number are some that thrive remarkably well, and form very fine specimens, particularly *Abies Douglasii*, *A. Nordmanniana*, *Cypresses*, and the *Wellingtonia*. Neither the *Araucaria* nor the *Deodar*, however, seems to thrive well, the soil probably being too light for them. *Pinus excelsa* makes fine growth for a while, but eventually loses its leader when it rises beyond the protection of other trees, and then becomes squat and branchy. Most of the other free-growing Conifers make handsome trees in sheltered places.

CHESWARDINE. C. DONALDSON HUDSON, Esq.

Correspondent: Mr. WM. WEEKS, Cheswardine, Market Drayton.

GENERAL REMARKS.—The following Conifers are growing here at an altitude of 550 feet, mostly in loam that has been well trenched, resting on an open gravelly subsoil, through which water passes freely.

Abies concolor.—Does well in sandy loam, and keeps its colour in any open place.

A. Douglasii.—Succeeds well in trenched loam, on an open bottom, in any exposure; but the colour is much richer in sheltered places. We have cut down trees of the Douglas Fir for cabinet work, and found the wood excellent for such a purpose. A fine specimen, thirty years old, is 50 ft. high, girths 4 ft. at five feet up, and its branches have a diameter of 27 ft., forming a very handsome tree.

A. grandis.—Grows fast in similar soil, but is best coloured when grown in the open.

A. magnifica.—Grown in the same soil, in an open spot, forms a beautiful and rich-coloured specimen.

A. Menziesii.—Thrives well, and retains a good colour, especially on a rough gravelly subsoil.

A. nobilis.—Is quite a success; but it makes the best growth in an open clayey loam, with a damp clay bottom.

A. Nordmanniana.—Grows most luxuriantly, and is a complete success, even in exposed places; and its bright, cheerful colour makes it very suitable for a memorial specimen tree.

A. pungens.—Grows successfully in any good loam, with an open, clayey subsoil, and forms a most beautiful specimen, retaining its rich glaucous hue all the year round. It is the finest of all the spruces for producing a stately and picturesque effect in dressed grounds.

Araucaria imbricata.—Thrives well in a deep sandy loam, on an open subsoil; but it does not do so well on a cold, clayey subsoil.

Cedrus atlantica.—Does fairly well on any soil, but assumes its best glaucous blue tints when planted in a free loam on an open gravelly subsoil. A fine tree growing here is thirty years old, 45 ft. high, 4 ft. 6 in. in girth at five feet up, with a spread of branches 24 ft. in diameter; a very handsome specimen.

C. Deodara.—Does not thrive so well on the gravelly subsoil, and soon loses its colour; requiring evidently a strong soil to get it in its best condition.

Cupressus Lawsoniana.—Thrives remarkably well, and is not in the least particular as to either soil or subsoil, but is most vigorous on a moist but open clayey subsoil. A grand specimen is 40 ft. in height at thirty years of age.

C. macrocarpa.—Thrives luxuriantly, and makes fine, clean growth, in a friable loam, on a clayey subsoil, and has attained a height of 40 ft. in twenty years.

Pinus austriaca.—Grows vigorously on trenched loam, on any kind of subsoil; but from its coarse growth and heavy top it is rather liable to be blown over in exposed places; still it is one of the best kinds for quickly making a game covert. It is 40 ft. high at twenty-five years old.

P. excelsa.—Thrives well and retains its colour best in strong loam, on a porous clayey subsoil. A tree twenty-six years old is 40 ft. high, and the branches have a spread of 30 ft. in diameter.

P. insignis.—Thrives tolerably well in a free loam, on gravel, and assumes a better habit than when grown on a richer soil.

P. Lambertiana.—Succeeds well, grows fast, and makes a fine specimen.

Taxodium sempervirens.—Does fairly well, but requires a sheltered spot.

Thuyopsis borealis.—Makes strong, healthy growth, and forms a beautiful specimen, standing the exposure well at this elevated spot, so that it is planted everywhere. A fine specimen at thirty years of age is over 40 ft. high.

Wellingtonia gigantea.—Thrives best in sheltered places, in deep loam, on a sandy subsoil, where it makes a fine clean growth, with foliage of a good colour. On a thin soil and dry gravelly subsoil, or in places where it is exposed to the cold, cutting winds, it soon begins to turn rusty, and the branchlets die off next the stem. On deep soil and an open rocky bottom it thrives so remarkably well that it is difficult to conceive it to be the same tree.

WARWICKSHIRE.

RAGLEY HALL. MARQUIS OF HERTFORD.

Altitude, 250 feet. Soil, marly loam; subsoil, rocky.

Correspondent: Mr. ALEXANDER D. CHRISTIE, The Gardens, Ragley Hall, Alcester.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	16	32	2 6	20	Sheld.	Very healthy & thriving.
„ <i>nobilis</i>	18	18	1 4	11	„	Doing fairly well, healthy.
„ <i>Nordmanniana</i> ...	18	24	1 10	16	„	Splendid specimens.
„ <i>Pinsapo</i>	18	25	1 10	18	„	Very beautiful specimens.
„ „ <i>glauca</i> ...	18	25	1 10	17	„	
„ <i>Veitchii</i>	17	24	1 10	16	„	Handsome and vigorous.
<i>Cedrus Deodara</i>	18	24	1 9	18	„	
<i>Cupressus Lawsoniana</i> ...	17	25	2 0	12	„	Many fine specimens
<i>Thuja gigantea</i>	18	36	2 6	15	„	
<i>Wellingtonia gigantea</i> ...	17	34	3 0	14	„	Very "handsome"; healthy.

GENERAL REMARKS.—These are all fine specimens, of about the same age, and in the most vigorous health. On the strong marly loam here, we can show that *Abies Douglasii*, *A. Nordmanniana*, *A. Pinsapo*, *Cupressus Lawsoniana*, *Thuja gigantea*, and *Wellingtonia gigantea* have really made much better trees than Common Spruce, Larch, Scots Fir, Beech, and other hardwoods, all planted at the same time and in the same way. Many other varieties of ornamental Conifers have also been planted, and they are generally in a fine thriving condition.

WORCESTERSHIRE.

EARDISTON. GEORGE WALLACE, Esq.

Altitude, 100 to 200 feet. Soil, rich loam; subsoil, strong marl.

Correspondent: Mr. HENRY RITCHIE, The Gardens, Eardiston, Tenbury.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies nobilis</i>	40	56	4 6	20	W.	Doing well; vigorous. [years
„ <i>Nordmanniana</i>	25	38	3 2	22	„	Does well; but fails at 25 or 30
<i>Araucaria imbricata</i> ...	30	30	2 6	14	„	Very good specimen.
<i>Cedrus atlantica</i>	30	40	4 6	27	„	
„ <i>Deodara</i>	—	55	7 0	36	„	Very fine specimen.
<i>Cupressus Lawsoniana</i> ...	25	28	2 3	10	„	
<i>Libocedrus decurrens</i> ...	30	16	2 0	6	„	Good specimen.
<i>Pinus austriaca</i>	40	45	6 0	30	Open	Branchy tree; healthy.
„ <i>insignis</i>	28	42	3 9	39	„	
<i>Thuyopsis borealis</i> ...	30	33	2 6	20	W.	Beautiful specimen.
<i>Wellingtonia gigantea</i> ...	30	35	5 0	20	„	Good; but now going back.

GENERAL REMARKS.—It may be mentioned that the Cedars, Cyresses, and *Thuopsis borealis* are the most thriving Conifers on the deep rich loam of the Teme Valley. Most of the Firs and Pines seem to go back after their roots penetrate to the stiff marly subsoil, although for a few years after they are planted they grow vigorously. From the same cause good specimens of *Wellingtonia* are showing signs of failing health.

HEWELL GRANGE. LORD WINDSOR.

Altitude, high and exposed. Soil, light loam; subsoil, rocky.

Correspondent: Mr. EDWARD WARD, The Gardens, Hewell Grange, Bromsgrove.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies cephalonica</i>	40	55	5 0	30	Fully exps'd	Fine specimen.
„ <i>Douglasii</i>	50	75	6 6	40	„	Feathered to the ground.
„ <i>grandis</i>	20	36	2 6	24	„	A very fine tree.
„ <i>magnifica</i>	20	22	2 0	10	„	„
„ <i>nobilis</i>	35	50	5 6	30	„	A good thriving specimen.
„ <i>Nordmanniana</i>	30	45	3 6	40	„	„
„ <i>orientalis</i>	35	35	2 6	25	„	„
„ <i>Pindrow</i>	30	42	3 6	20	„	A fine healthy tree.
„ <i>Smithiana</i>	30	45	5 0	25	„	Handsome specimen.
„ <i>Webbiana</i>	40	45	4 0	25	„	Good specimen.
<i>Araucaria imbricata</i>	30	25	4 0	30	„	„
<i>Cedrus atlantica</i>	45	55	5 6	40	„	Very fine trees.
„ <i>Deodara</i>	40	55	7 6	40	„	„
„ <i>Libani</i>	100	50	16 0	80	„	Fine old specimen.
<i>Cupressus Lawsoniana</i> ...	25	35	—	18	„	Fine; used for hedges.
„ <i>pendula</i>	28	40	2 0	15	„	Beautiful var.; does well.
„ <i>macrocarpa</i> ...	25	30	3 6	—	„	Good specimen.
<i>Larix europæa</i>	75	80	11 0	60	„	Fine straight timber.
<i>Libocedrus decurrens</i> ...	25	30	—	9	„	Good specimen.
<i>Pinus Cembra</i>	70	45	7 0	25	„	„
„ <i>excelsa</i>	60	50	7 6	52	„	Wide-spreading tree.
„ <i>Laricio</i>	70	75	7 6	20	„	Fine straight stem.
„ <i>Pallasiana</i>	30	30	4 6	30	„	A good specimen.
„ <i>Pinaster</i>	80	68	10 0	20	„	A grand tree.
„ <i>Pinea</i>	50	30	4 0	20	„	A good specimen.
„ <i>ponderosa</i>	30	35	3 0	20	„	„
„ <i>Strobus</i>	40	35	5 6	25	„	„
„ <i>sylvestris</i>	75	90	9 6	30	„	Fine clean straight stem.
<i>Taxodium distichum</i> <i>pendulum</i>	50	50	6 0	15	„	Beautiful tree.
„ <i>sempervirens</i>	50	65	8 0	30	„	Fine specimen.
<i>Thuya Lobbii</i>	40	50	3 0	20	„	„
<i>Wellingtonia gigantea</i> ...	35	50	7 6	20	„	„

GENERAL REMARKS.—The Conifers above noted are growing in fully exposed positions on the highest table-land in the Midlands. The soil is a light sandy loam, resting on limestone rock, on which most Conifers do well. The grand old tree of *Pinus Pinaster* grows on an island in a lake of thirty-two acres, and is fully exposed.

YORKSHIRE.

MULGRAVE CASTLE. MARQUIS OF NORMANBY.

Altitude, 50 feet. Soil, loam; subsoil, clay.

Correspondent: Mr. J. CORBETT, The Gardens, Mulgrave Castle, Whitby.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	60	66	7 10	54	Sheltd.	Beautiful specimen.
<i>Araucaria imbricata</i>	90	37	4 5	32	"	"
<i>Cedrus atlantica</i>	—	66	5 10	28	"	Thrives well; very fine.
" <i>Deodara</i>	56	45	5 6	27	"	"
<i>Pinus Cembra</i>	63	40	5 4	22	"	"
<i>Wellingtonia gigantea</i> ...	25	40	4 10	15	"	Vigorous; fine specimen.

GENERAL REMARKS.—The above trees are all in vigorous health. The Douglas Fir is a splendid specimen, growing as it does so near to the East Coast. The *Araucaria* is said to be one of the first planted in England and coeval with the oldest specimen at Kew.

STUDLEY ROYAL. MARQUIS OF RIPON.

Altitude, 280 to 320 feet. Soil, loam; subsoil, limestone.

Correspondent: Mr. JOHN CLARK, The Gardens, Studley Royal, Ripon.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies canadensis</i>	Agd. 60	10 0	66	Sheltd.		Very fine specimen.
" <i>cephalonica</i>	60	75	8 3	—	"	"
" <i>concolor</i>	30	40	3 0	—	S.	Fine specimen.
" <i>excelsa</i>	Agd. 132	12 6	—	Sheltd.		Very fine specimen.
" <i>Menziesii</i>	—	45	2 10	—	"	Not a good specimen.
" <i>nobilis</i>	—	12	—	—	"	Thriving young tree.
" <i>Nordmanniana</i> ...	30	40	2 9	—	S.	Fair specimen.
" <i>Pinsapo</i>	30	35	3 0	—	"	"
<i>Araucaria imbricata</i>	—	30	2 0	—	"	"
<i>Cedrus Deodara</i>	60	70	7 6	52	"	Very fine specimen.
<i>Cupressus Lawsoniana</i> ...	30	40	—	—	"	Hardy and free growing.
<i>Juniperus Virginiana</i> ...	Agd. 70	6 0	—	Sheltd.		Very fine specimen.
<i>Pinus austriaca</i>	"	70	6 6	—	S.	Large, but not choice.
" <i>Cembra</i>	60	60	4 0	—	"	Good specimen.
" <i>excelsa</i>	60	70	6 0	—	"	Fine specimen.
" <i>Laricio</i>	60	70	5 0	—	Sheltd.	Fair specimen.
" <i>ponderosa</i>	30	30	3 6	—	S.	"
" <i>sylvestris</i>	Agd. 90	11 3	—	Sheltd.		Very fine specimen.
<i>Taxodium sempervirens</i>	—	30	—	—	S.	Not a good specimen.
<i>Thuya gigantea</i>	30	42	2 6	—	"	Nice specimen.
<i>Thuyopsis borealis</i>	30	30	—	—	"	"
<i>Wellingtonia gigantea</i> ...	28	72	8 0	15	"	A perfect specimen.

GENERAL REMARKS.—Of the above-mentioned Conifers, *Abies canadensis*, *A. excelsa*, *Juniperus virginiana*, and *Pinus sylvestris*, all very fine specimens of their kind, are growing in the public pleasure grounds at Studley Royal. All the others grow in the private pleasure grounds, and most of them are good specimens in vigorous health.

SCOTLAND.

II.—STATISTICS OF CONIFERS IN SCOTLAND.

ABERDEENSHIRE.

BALMORAL. HER MAJESTY THE QUEEN.

Altitude, 900 to 950 feet. Soil, varied, from sandy loam to moorish; subsoil, gravelly with boulders.

Correspondent: Mr. JOHN MICHIE, Forester, Danzig, Ballater.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	26	35	2 6	17	N.	{ Planted by H.R.H. Princess Beatrice in 1865. One of the best Firs.
„ <i>concolor</i>	26	37	3 8	13	„	Very healthy and vigorous.
„ <i>Douglasii</i>	25	47	4 3	36	W.	Most satisfactory.
„ <i>grandis</i>	16	29	1 10	14	„	Very vigorous.
„ <i>magnifica</i>	16	29	3 2	10	„	Fine ornamental tree.
„ <i>nobilis</i>	26	40	3 3	15	„	„
<i>Pinus Cembra</i>	42	42	4 1	20	„	One of the "hardest" & best.
„ <i>Jeffreyi</i>	27	22	1 11	11	„	Hardy and ornamental.
„ <i>monticola</i>	25	23	1 10	9	„	Fine hardy Pine.
<i>Wellingtonia gigantea</i> ..	25	29	4 1	15	„	Often browned in winter.

GENERAL REMARKS.—Among the newer Coniferae which have been tried at this high altitude, three species have proved themselves to be decidedly hardier than any of the others, and have successfully withstood the severest winter, spring, and even summer frosts which prevail in this district. These are *Abies Douglasii*, *Pinus Cembra*, and *Thuyopsis borealis*, all of which take kindly to the soil and climate, and seem to thrive anywhere here. *Abies Albertiana* is not far behind them, although it does not stand exposure to wind so well, and sometimes gets slightly frosted, owing to the tender young shoots beginning to expand before the season of early summer frosts are past. *Abies concolor*, *A. grandis*, *A. magnifica*, and *A. nobilis* all grow vigorously, but occasionally suffer from frostbite in spring. *A. Menziesii* does not thrive on the poor thin soil; and *A. Nordmanniana*, as a rule, becomes unhealthy and infested with insects after a time. The severity of the winter proves fatal to *Araucaria imbricata*; and from the same cause none of the Cedars can make any headway, but, after struggling a few years in a crippled state, ultimately die out. *Pinus excelsa* and *P. insignis* are also too tender

for this district. *P. austriaca* grows slowly, is very coarse, and is not suitable for a timber tree; *P. Laricio* is in the same category, stunted in growth, and not ornamental here. *Cupressus Lawsoniana* has been planted in considerable numbers, and thrives well, but is not promising to make a useful timber tree; the finest specimens have only reached a height of 20 ft. in thirty years, forming beautiful, healthy, and well-furnished large bushes or small trees. *Wellingtonia gigantea* grows fairly well, but suffers much from the severity of the winter.

HADDO ESTATE. EARL OF ABERDEEN.

Altitude, 190 feet. Soil, light loam; subsoil, open sand and gravel.

Correspondent: Mr. JOHN CLARK, Forester, Haddo, Aberdeen.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	17	10	—	6	Open	Healthy.
„ <i>balsamea</i>	„	23	—	8	„	Vigorous.
„ <i>cephalonica</i>	„	17	—	10	„	Healthy and thriving.
„ <i>Douglasii</i>	„	24	—	13	„	Very vigorous.
„ <i>excelsa</i>	„	25	—	8	„	„
„ <i>grandis</i>	„	26	—	12	„	„
„ <i>Menziesii</i>	„	20	—	9	„	„
„ <i>nigra</i>	„	17	—	7	„	Healthy.
„ <i>nobilis</i>	„	24	—	13	„	Very vigorous.
„ „ <i>glauca</i>	„	20	—	10	„	„
„ <i>Nordmanniana</i>	„	21	—	10	„	„
„ <i>orientalis</i>	„	15	—	9	„	Healthy and thriving.
„ <i>pectinata</i>	„	21	—	8	„	Vigorous.
<i>Pinus Cembra</i>	„	17	—	5	„	„
„ <i>sylvestris</i>	„	25	—	9	„	„
<i>Thuya gigantea</i>	„	21	—	10	„	„
<i>Thuyopsis borealis</i>	„	11	—	6	„	Very healthy.

GENERAL REMARKS.—The above trees were planted as ordinary plantation trees in 1874, all under similar conditions, and they are in general thriving well and growing vigorously.

HADDO HOUSE. EARL OF ABERDEEN.

Altitude, 110 to 190 feet. Soil, light loam; subsoil, sandy clay and gravel.

Correspondent: Mr. JOHN FORREST, The Gardens, Haddo, Aberdeen.

Botanical Name	Age	Height	Girth at 5 ft. up		Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft.	In.	Feet		
<i>Abies Albertiana</i>	35	45	3	9	30	S.E.	Healthy and vigorous.
„ <i>amabilis</i> (?)	20	29	2	0	10	„	„ „
„ <i>cephalonica</i>	40	48	6	0	24	S.W.	„ „
„ <i>concolor</i>	22	40	4	0	40	W.	„ „
„ <i>Douglasii</i>	40	73	8	1	44	S.E.	„ „
„ <i>grandis</i>	20	27	1	11	8	„	„ „
„ <i>magnifica</i>	20	28	2	0	9	„	„ „
„ <i>Menziesii</i>	35	66	5	0	26	N.E.	„ „
„ <i>nobilis</i>	35	64	6	6	25	S.E.	„ „
„ <i>Nordmanniana</i> ...	35	42	3	0	17	„	„ „
<i>Araucaria imbricata</i> ...	30	28	2	4	13	N.W.	A fine specimen.
<i>Cupressus Lawsoniana</i>	30	29	4	8	14	N.E.	Healthy and vigorous.
<i>Pinus Cembra</i>	40	39	4	5	17	S.E.	„ „
„ <i>Pinaster</i>	40	43	6	0	27	„	„ „
<i>Thuja gigantea</i>	20	31	2	10	15	„	„ „
<i>Thuyopsis borealis</i>	15	14	1	0	9	„	„ „
<i>Wellingtonia gigantea</i>	35	50	8	2	25	S.W.	Pltd. by Queen Victoria.
„ „	35	50	8	4	23	„	„ Prince Consort.

GENERAL REMARKS.—The new Coniferae are thriving well here, and making fine specimens, of which those in the table are among the best. *Abies amabilis* was received from the nurseries under that name about twenty years ago, but it is very like *A. magnifica*; both growing vigorously here, and forming very beautiful trees.

ARGYLLSHIRE.

INVERARY CASTLE. DUKE OF ARGYLL.

Altitude, 15 to 70 feet. Soil, deep loam, and light loam; subsoil, gravelly and rocky.

Correspondent : Mr. GEORGE TAYLOR, The Castle Gardens, Inverary.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	50	3 10	24	S.	Very vigorous.
„ <i>concolor</i>	16	20	1 3	9	„	Healthy specimen.
„ <i>Douglasii</i>	45	60	6 3	40	„	Grows fast in shelter.
„ <i>grandis</i>	27	45	7 1	37	„	Growing freely; exposed.
„ <i>magnifica</i>	7	7	—	—	„	Promising well.
„ <i>Menziesii</i>	35	55	5 11	33	„	Grows very strongly.
„ <i>nobilis</i>	33	46	4 3	23	W.	Doing well.
„ <i>Nordmanniana</i> ...	26	34	2 9	10	S.	Generally grows slowly.
<i>Araucaria imbricata</i>	35	35	4 3	18	S.W.	Fine specimen.
<i>Cedrus atlantica</i>	30	34	3 7	23	W.	Growing freely.
„ <i>Deodara</i>	39	37	5 2	27	„	Slow growing; exposed.
<i>Cryptomeria japonica</i> ...	33	25	4 4 $\frac{1}{2}$	23	S.	Healthy; not grwn. fast.
<i>Cupressus Lawsoniana</i> ...	34	49	4 9	18	S.E.	Making fine growth.
„ <i>macrocarpa</i> ...	30	35	4 1	18	S.	Healthy; growing well.
<i>Pinus Cembra</i>	18	18	1 6	8	„	Slow growing.
„ <i>Laricio</i>	40	45	2 4	—	W.	Rough, straggling tree.
„ <i>monticola</i>	16	26	2 2	15	S.E.	Vigorous, fine tree.
<i>Taxodium sempervirens</i>	35	39	6 3	30	S.	Often loses its leader.
<i>Thuja gigantea</i>	24	25	3 3	20	S.W.	Very exposed.
<i>Thuyopsis borealis</i>	27	29	2 6	15	S.	A very beautiful tree.
<i>Wellingtonia gigantea</i> ...	28	51	5 1	21	S.E.	Vigorous; handsome tree.

GENERAL REMARKS.—Most of the specimens of which details are given above are growing in the grounds here, in a deep friable loam, in which they thrive well, at a comparatively low altitude on the western shore of Loch Fyne. Nearly all the Spruces and Firs grow with vigour, especially when sheltered; as do also the Cypressess, Arborvites, and the Wellingtonia. The *Araucaria* thrives well, and so does the Redwood; only the latter is apt to lose its leading shoot from wind, frost, or other causes. Pines do not grow well in most situations here—*Pinus monticola* being about the best of the newer ones; they generally present a bare scrubby appearance. *Thuja gigantea* and *Thuyopsis borealis* grow fast in shelter, and form beautiful trees. *Cupressus Lawsoniana* and *C. macrocarpa* thrive well and make fine specimens. The *Abies grandis* in the list has several times lost its leader; and *Taxodium sempervirens* suffers from the same cause whenever it is exposed to high wind.

POLTALLOCH. JOHN MALCOLM, Esq., of Poltalloch.

Altitude, from 120 to 200 feet. Soil, loam and peat; subsoil, gravel and rock.

Correspondent: Mr. JAMES RUSSELL, The Gardens, Poltalloch, Lochgilphead.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	—	40	5 0	25	E.	Growing vigorously.
„ <i>amabilis</i> (?)	—	24	2 0	12	S.E.	„ „
„ <i>canadensis</i>	—	55	4 0	25	N.	„ „
„ <i>cephalonica</i>	—	30	2 0	20	N.W.	„ „
„ <i>concolor</i>	—	40	5 0	20	E.	„ „
„ <i>Douglasii</i>	—	85	10 0	34	S.E.	„ „
„ <i>grandis</i>	—	64	7 9	30	„	„ „
„ <i>Menziesii</i>	—	35	2 6	24	„	„ moderately.
„ <i>Nordmanniana</i> ...	—	70	6 0	35	S.	„ vigorously.
„ <i>Pinsapo</i>	—	40	7 0	33	S.W.	„ moderately.
„ <i>Webbiana</i>	—	30	2 6	16	N.	„ „
<i>Araucaria imbricata</i> ...	—	55	6 0	30	S.	„ „
<i>Cedrus Deodara</i>	—	45	4 0	30	S.E.	„ „
„ <i>Libani</i>	—	35	3 0	30	„	„ „
<i>Cryptomeria elegans</i> ...	—	24	1 0	16	N.	„ weakly.
„ <i>japonica</i> ...	—	30	2 6	16	W.	„ moderately.
<i>Cupressus Lawsoniana</i>	—	20	2 0	12	S.E.	„ „
<i>Pinus Lambertiana</i>	—	45	9 0	35	E.	„ vigorously.
„ <i>monticola</i>	—	45	3 0	25	N.W.	„ „
<i>Prumnopitys elegans</i> ...	—	13	1 0	9	S.W.	„ moderately.
<i>Retinospora obtusa</i> ...	—	12	1 0	8	W.	„ weakly.
<i>Taxodium sempervirens</i>	—	35	5 6	24	S.	„ moderately.
<i>Thuja gigantea</i>	—	65	5 0	35	N.W.	„ vigorously.
„ <i>orientalis aurea</i>	—	30	2 0	12	W.	„ moderately.
<i>Thuyopsis borealis</i>	—	30	3 0	20	N.W.	„ vigorously.
„ <i>dolabrata</i> ...	—	12	1 0	8	W.	„ moderately.
<i>Wellingtonia gigantea</i>	—	45	9 6	28	S.E.	„ vigorously.

GENERAL REMARKS.—Conifers generally thrive well here, and most of them are growing vigorously; especially *Abies Douglasii*, *A. grandis*, *A. Nordmanniana*, and *Thuja gigantea*. The *Araucaria*, Cedars, and Cypresses, as well as the *Cryptomerias* and *Wellingtonia*, are thriving well, in sheltered places in the grounds and woods.

TORLOISK, ISLE OF MULL. MARQUIS OF NORTHAMPTON.

Altitude, 30 to 100 feet. Soil, loamy and peaty; subsoil, porous rock.

Correspondent: Mr. CHARLES GRIERSON, The Gardens, Torloisk, Tobermory.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	35	43	5 2	27	S.E.	Grows vigorously.
„ <i>nobilis</i>	22	37	3 6	19	„	„ „
„ <i>Webbiana</i>	35	49	4 10	34	„	„ „
<i>Araucaria imbricata</i> ...	40	39	6 2	29	„	A perfect specimen.
<i>Cedrus Deodara</i>	35	39	4 6	23	„	Doing well.
<i>Cupressus Lambertiana</i>	35	43	9 3	50	„	Girth at 1 foot up.
„ <i>Lawsoniana</i>	35	34	8 6	23	„	„ „
„ <i>macrocarpa</i>	35	42	7 6	55	„	„ „
<i>Libocedrus decurrens</i> ...	35	37	6 3	28	„	„ „
<i>Pinus insignis</i>	30	55	6 0	30	„	„ „
<i>Retinospora obtusa</i>	25	21	5 0	22	„	„ „
<i>Taxodium sempervirens</i>	35	32	5 4	19	„	Leader often broken.
<i>Thuyopsis borealis</i>	35	31	6 0	22	„	Girth at 1 foot up.

GENERAL REMARKS.—The above Conifers, and many others, grow and thrive well here, especially when sheltered from the direct blast, off the Atlantic Ocean, which sweeps over us from the west with great force. The soil is a good sandy loam, or of a peaty nature, both resting on a porous, rotten rock, through which water percolates freely, so that the heavy rainfall of the district never sours the soil and is beneficial to the Conifers. *Abies Douglasii*, *A. nobilis*, and *Taxodium sempervirens* grow very freely, but they are very liable to get their leaders injured by the Atlantic gales, whenever they rise above the surrounding shelter. *Cupressus Lambertiana* and *C. macrocarpa* grow with great vigour, and seem to luxuriate in the saline blast, forming remarkably healthy and wide-spreading trees. *Araucaria imbricata* and *Pinus insignis* also grow vigorously, and seem to be very suitable for the soil and climate. *Abies Webbiana*, *Thuyopsis borealis*, *Cupressus Lawsoniana*, *Libocedrus decurrens*, *Cedrus Deodara*, and others, all thrive well and make beautiful specimens. *Abies Webbiana* is perfectly hardy, and the tree of which the dimensions are given in the table is a splendid specimen. The *Araucaria* mentioned above is a splendid tree, well furnished with healthy branches from top to bottom, and this season bearing eighteen fine large cones, from which we expect to get some fertile seeds. The *Deodar* is also bearing cones, for the first time here. Some of the oldest and finest specimens of our Conifers, especially the Cyresses, fork into several stems at a short height above the ground, an objectionable feature which can be easily remedied if the trees are properly looked after in their early stages of growth. Such forked and branchy trees are very liable to be twisted and broken, or split to the ground, by high winds or a heavy fall of snow. A careful attention to stopping all the leaders but one when the trees are young will cause them to grow with a single stout stem closely furnished with shapely compact branches and proof against injury from either wind or snow.

Among a fine healthy collection of Conifers growing at Duart House, the seat of A. C. Guthrie, Esq., under the care of Mr. J. Macphail, the gardener, there is a grand specimen of *Araucaria imbricata* in luxuriant health, and also bearing

about a dozen cones this season. Its dimensions are: 34 feet 6 inches high; 6 feet 11 inches in girth of stem at 5 feet up; and 8 feet in girth at 1 foot from the ground; diameter of spread of branches, 40 feet, and well furnished from the ground to the top. It is growing at an altitude of about 40 feet; in a light loamy soil, on an open subsoil; exposed to the south-east, but sheltered in other directions; and is about 60 years of age. A fine specimen of *Thuja gigantea* also grows at Duart in a similar soil, at an altitude of about 20 feet, and in a western exposure. It is 30 years old; 46 feet high; girths 5 feet 4 inches at 5 feet up; and has a spread of branches 29 feet in diameter. Many other Conifers are thriving well at Duart besides these, and the best specimens of *Cryptomeria japonica* and *Pinus excelsa* in the island are among them.

BANFFSHIRE.

CULLEN HOUSE. DOWAGER COUNTESS OF SEAFIELD.

Altitude, from 50 to 250 feet. Soil, from light to heavy loam; subsoil, gravel and clay.

Correspondent: Mr. C. Y. MICHIE, Forester's Lodge, Cullen.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	20	3 0	13	Shltd.	Healthy; confined, N. side.
„ <i>concolor</i>	30	43	3 9	20	„	Vig.; lost top by frost when young.
„ <i>Douglasii</i>	30	60	6 0	28	„	Vig.; leader aver. 2ft. yrly.
„ <i>grandis</i>	30	24	3 0	18	„	Slow grower; top frosted.
„ <i>magnifica</i>	30	33	3 2	9	„	Sickly; soil unsuitable.
„ <i>Menziesii</i>	40	65	8 6	40	„	Vig.; branches super-abundant.
„ <i>nobilis</i>	40	55	6 4	25	„	Vig.; branches deficient.
„ <i>Nordmanniana</i> ...	40	65	5 3	42	„	„ beautif. symmetrical.
<i>Araucaria imbricata</i>	50	43	3 4	18	„	Healthy; a few branches failing.
<i>Cedrus atlantica</i>	35	39	4 1	27	„	Vigorous; beautiful; bearing cones.
„ <i>Deodara</i>	40	40	4 0	18	„	Very healthy; well shelterd.
<i>Cupressus Lawsoniana</i> ...	35	30	3 6	15	„	Vigorous; many branches at base.
<i>Pinus austriaca</i>	34	28	2 6	14	Exp.N.	Hlthy.; cones occasionally.
„ <i>Cembra</i>	33	32	3 6	18	Sheld.	Vig.; well branched.
„ <i>excelsa</i>	35	34	3 6	24	„	Hlthy.; branches rambling.
„ <i>insignis</i>	40	47	6 2	34	„	Vig.; liable to pine beetle.
„ <i>Jeffreyi</i>	25	19	1 7	10	„	Stunted; attenuated form.
<i>Thuyopsis borealis</i>	15	22	1 10	14	„	Vigorous; fine feathery appearance.
<i>Wellingtonia gigantea</i> ...	35	57	4 10	17	„	Hlthy; deficient of brnchs.

GENERAL REMARKS.—The above specimens are generally doing well and making good growth. There are very few cones on any of the trees this season, although last year they were in great abundance on many of them.

BUTESHIRE.

ISLE OF BUTE. MARQUIS OF BUTE.

Altitude, 50 to 120 feet. Soil, gravelly loam and clay; subsoil, rocky.

Correspondent: Mr. JAMES KAY, Forester, Bute Estates, Rothesay.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet	S.	
<i>Abies Albertiana</i>	34	61	4 11	—	S.	Fine healthy tree.
„ <i>Douglasii</i>	34	80	6 4	—	Shelt.	Very fine healthy tree.
„ <i>grandis</i>	—	33	2 6 $\frac{1}{2}$	—	„	Very fine specimen.
„ <i>Morinda</i>	—	52	5 2 $\frac{1}{2}$	—	„	Vigorous; beautiful tree.
„ <i>nigra</i>	—	46	3 5	—	„	Moderate growth.
„ <i>nobilis</i>	—	54	2 11 $\frac{1}{2}$	—	„	Vigorous; a grand tree.
<i>Araucaria imbricata</i> ...	34	34	3 10 $\frac{1}{2}$	—	„	Vig; beautiful specimen.
<i>Cedrus Libani</i>	—	—	7 5	—	„	Mod. growth; fine tree.
<i>Cryptomeria japonica</i> ...	—	38	4 7 $\frac{1}{2}$	—	„	Vigorous; a very fine tree.
<i>Cupressus macrocarpa</i>	—	57	5 8 $\frac{1}{2}$	—	„	Vigorous; splendid tree.
<i>Pinus Hartwegii</i>	—	33	1 10	—	„	Sickly.
„ <i>insignis</i>	34	57	4 11	—	„	Healthy; very fine tree.
<i>Taxodium sempervirens</i>	—	46	4 1	—	„	„ „
<i>Thuja gigantea</i>	—	44	3 4 $\frac{1}{2}$	—	„	„ „
<i>Thuyopsis borealis</i>	—	27	1 9	—	„	Mod. growth; beautif. tree.
<i>Wellingtonia gigantea</i>	—	46	3 5	—	„	„ fine tree.

GENERAL REMARKS.—The Conifers named are among the best in the Island of Bute. Most of them are growing at Mount Stuart, and a few in the neighbourhood of Rothesay. The locality is favourable, and the soil fairly good, so that, when they are sheltered from the blast, most hardy Conifers thrive well in the comparatively mild climate of this island. I have not observed any cones on them this year; but in most seasons they bear a good number, many of which produce fertile seeds. *Abies Albertiana* and *A. Douglasii* are very fine trees, in vigorous health, and the *Araucaria* is a splendid specimen. *Cryptomeria japonica* and *Cupressus macrocarpa*, as well as *Pinus insignis*, *Thuja gigantea* (*T. Lobbii*), and *Thuyopsis borealis*, thrive well and are making very handsome specimens. The Redwood and *Wellingtonia* are also very fine trees.

DUMBARTONSHIRE.

ROSSDHU. SIR JAMES COLQUHOUN, Bart.

Altitude, 20 feet to 50 feet. Soil, light loam; subsoil, gravel.

Correspondent: Mr. FINLAY MCPHERSON, The Gardens, Rossdhu, Luss.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	—	40	3 0	—	Sheltd.	Vigorous.
„ <i>amabilis</i> (?)	—	20	2 0	—	„	Healthy.
„ <i>cephalonica</i>	—	55	6 9	—	„	Vigorous.
„ <i>ciliacea</i>	—	10	0 6	—	„	Healthy.
„ <i>concolor</i>	—	18	0 6	—	„	„
„ <i>Douglasii</i>	—	70	10 3	—	„	Vigorous.
„ <i>grandis</i>	—	45	5 4	—	S.	Moderate growth.
„ <i>Menziesii</i>	—	90	10 1	—	Sheltd.	Vigorous.
„ <i>nobilis</i>	—	48	4 3	—	S.	„
„ <i>Nordmanniana</i>	—	35	2 6	—	„	„
„ <i>pectinata</i>	108	110	17 9	—	Expsd.	Very healthy.
„ <i>Pinsapo</i>	—	12	1 0	—	S.	Vigorous.
<i>Araucaria imbricata</i>	—	32	3 9	—	„	„
<i>Cedrus atlantica</i>	—	24	4 0	—	„	Moderate.
„ <i>Deodara</i>	—	55	4 10	—	Expsd.	„
<i>Cryptomeria japonica</i> ...	—	35	2 4	—	S.	„
<i>Cupressus Lawsoniana</i> ...	—	20	2 3	—	„	Vigorous.
„ <i>lusitanica</i>	—	39	2 9	—	Sheltd.	Moderate.
<i>Fitzroya patagonica</i>	—	18	1 6	—	„	„
<i>Larix europæa</i>	100	10	0	—	„	Vigorous.
<i>Pinus austriaca</i>	—	25	2 9	—	S.	Moderate.
„ <i>Cembra</i>	—	25	2 7	—	Sheltd.	„
„ <i>excelsa</i>	—	40	4 0	—	„	Vigorous.
„ <i>monticola</i>	—	50	3 8	—	Expsd.	Healthy.
„ <i>sylvestris</i>	—	65	11 0	—	Sheltd.	Vigorous.
<i>Retinospora pisifera</i>	—	18	2 0	—	„	„
„ <i>plumosa aurea</i>	—	15	1 8	—	„	„
<i>Taxodium distichum</i>	—	30	3 5	—	„	„
„ <i>sempervirens</i> ...	—	44	3 0	—	„	„
<i>Taxus baccata</i>	400	40	13 0	—	„	Healthy.
<i>Thuja gigantea</i>	—	35	2 8	—	„	Vigorous.
<i>Thuyopsis borealis</i>	—	14	2 1	—	„	Moderate.
„ <i>dolabrata</i>	—	11	1 6	—	„	Vigorous.
<i>Wellingtonia gigantea</i> ...	—	65	11 0	—	„	„

GENERAL REMARKS.—Some of the above are extra fine specimens. Nearly all hardy Conifers thrive well here, and also some of those considered to be rather tender in many parts of the country.

DUMFRIESSHIRE.

CASTLEMILK. SIR ROBERT JARDINE, Bart.

Altitude, 230 to 250 feet. Soil, light and heavy loam; subsoil, gravel and boulder clay.

Correspondent: Mr. WILLIAM KING, The Gardens, Castlemilk, Lockerbie.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	24	37	3 6	22	Sheldt.	Healthy; free growing.
„ <i>concolor</i>	30	40	4 0	20	„	„
„ <i>Douglasii</i>	30	45	6 0	34	„	Vigorous and fine tree.
„ <i>nobilis</i>	24	35	4 4	27	„	Last 10 yrs. growth, 21½ ft.
„ <i>Nordmanniana</i> ...	20	27	1 10	14	„	„ 20 ft.
<i>Araucaria imbricata</i> ...	15	22	2 0	14	Expsd.	Fine vigorous tree.
<i>Cedrus atlantica</i>	25	25	3 3	11	„	Moderate growth.
„ <i>Deodara</i>	25	21	2 7	16	„	„
<i>Cupressus Lawsoniana</i>	25	30	2 10	13	Sheldt.	Very fine specimen.
<i>Pinus austriaca</i>	25	18	2 6	8	„	Moderate growth.
„ <i>excelsa</i>	24	25	2 0	12	„	„
„ <i>Jeffreyi</i>	25	28	1 10	12	„	Last 10 yrs. growth, 13 ft.
<i>Thuopsis borealis</i>	25	30	2 10	15	„	Vigorous and beautiful.
<i>Wellingtonia gigantea</i>	25	35	5 3	21	„	Handsome, vigorous tree.

GENERAL REMARKS.—Conifers thrive very well in this part of Dumfries-shire, and many of the recently planted species are growing vigorously—*Abies grandis*, for example—and promise to make fine specimens at an early age. All the hardy *Abies* seem to do extra well, *Abies nobilis* and *A. Nordmanniana* making fully two feet annually of a leading growth.

DRUMLANRIG. DUKE OF BUCCLEUCH.

Altitude, 200 to 700 feet. Soil, medium loam; subsoil, clay, gravel, and whinstone.

Correspondent: Mr. JOHN FINGLAND, Forester, Drumlanrig, Thornhill.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	21	31	2 10	24	S.	Vigorous growth.
„ <i>amabilis</i> (?)	17	32	3 0	12	E.	„ „
„ <i>concolor</i>	21	43	4 6	20	S.E.	„ „
„ <i>Douglasii</i>	26	52	6 0	44	N.E.	„ „
„ „ <i>taxifolia</i>	24	43	5 4	35	E.	„ „
„ <i>grandis</i>	20	49	4 9	25	S.W.	„ „
„ <i>magnifica</i>	18	38	2 10	18	N.E.	„ „
„ <i>Menziesii</i>	22	49	7 8	38	„	„ „
„ <i>nobilis</i>	17	42	3 4	18	E.	„ „
„ <i>Nordmanniana</i> ...	26	51	4 2	23	S.E.	„ „
„ <i>Pinsapo</i>	24	18	3 0	22	„	Not thriving.
<i>Araucaria imbricata</i> ...	36	47	4 9	24	N.E.	Growing vigorously.
<i>Cedrus atlantica</i>	30	28	3 0	19	S.E.	Moderate growth.
„ <i>Deodara</i>	30	26	3 6	12	N.E.	Vigorous „
„ <i>Libani</i>	40	47	4 0	28	S.E.	Moderate „
<i>Cryptomeria japonica</i>	30	27	3 10	18	„	Vigorous „
<i>Cupressus Lawsoniana</i>	26	29	3 9	12	N.E.	Moderate „
<i>Pinus austriaca</i>	40	34	4 6	22	E.	Not thriving; sickly.
„ <i>Cembra</i>	18	28	2 4	13	S.	Vigorous.
„ <i>Laricio</i>	20	23	2 0	11	N.E.	Not thriving; sickly.
„ <i>ponderosa</i>	30	44	3 2	18	E.	Moderate growth.
„ <i>Pumilio</i>	24	24	2 10	18	S.E.	Not thriving.
<i>Wellingtonia gigantea</i>	26	47	7 0	23	N.E.	Very vigorous.

GENERAL REMARKS.—Of the trees of which the details are given, *Abies amabilis*, *A. Douglasii*, *A. D. taxifolia*, *A. Menziesii*, *A. nobilis*, *A. Pinsapo*, *Araucaria imbricata*, *Cedrus atlantica*, *Cryptomeria japonica*, *Pinus austriaca*, *P. Cembra*, *P. Laricio*, *P. Pumilio*, and *Wellingtonia gigantea* are all growing at an altitude between 650 and 700 feet; and except *Abies Pinsapo*, *Pinus austriaca*, *P. Laricio*, and *P. Pumilio*, they are all growing vigorously. *Abies Albertiana*, *A. concolor*, and *A. grandis* are also thriving vigorously between 300 and 500 feet of altitude. A considerable number of those which have been found to thrive well have been planted on this estate.

JARDINE HALL. SIR A. JARDINE, Bart.

Altitude, 200 feet. Soil, light loam; subsoil, sandy gravel.

Correspondent: W. H. MAXWELL, Esq., of Munches, Dalbeattie,
Kircudbrightshire.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remark
<i>Abies Douglasii</i>	Years 63	Feet 67	Ft. In. 10 6	Feet 59	N.E.	Planted in 1828.

GENERAL REMARKS.—This fine tree, which stands in the middle of the garden, is figured in "Selby's Forest Trees," and is among the oldest of the Douglas Firs in Britain, having been planted in 1828, as a seedling 2 feet high. It is mentioned by Loudon as being 13 feet 2 inches high in 1837. In the same year (1828) a Douglas Fir was planted at Hedgeley, Northumberland, which in 1842 was 28 feet high, and girthed 3 feet at 6 inches from the ground, and 2 feet 1 inch at 18 inches up; with a spread of branches 20 feet in diameter.

The dimensions of the tree at Jardine Hall were at various periods as follows :

ABIES DOUGLASII, AT JARDINE HALL, LOCKERBIE:

Year	Height	Girth at base	Girth 1 ft. up	Girth 3 ft. up	Girth 5 ft. up	Diameter of Branches	Circum. of Branches	Remarks
	Ft.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Feet	Feet	
1828	2	—	—	—	—	—	—	Owing to a strong colony of crows meeting in this tree for the last 30 years or more, the top is much injured and broken, else it might have been over 100 feet by this time.
1842	25	—	2 9	—	—	—	—	
1845	—	—	3 8	—	—	—	—	
1875	—	—	11 0	—	8 6	—	—	
1880	—	—	12 0	10 3	—	55	170	
1884	—	15 6	12 7	11 0	10 0	60	1 2	
1887	70	16 0	—	11 0	10 0	62	1	

LANGHOLM. DUKE OF BUCCLEUCH.

Altitude, 200 feet. Soil, loam; subsoil, clay and gravel.

Correspondent: Mr. WILLIAM DOUGHTY, Forester, Canonbie.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	18	23	1 6	12	S.W.	Thriving; beautiful tree.
„ <i>Douglasii</i>	20	24	1 11	13	„	„ „
„ <i>nobilis</i>	20	17	1 4	9	„	„ „
„ <i>Nordmanniana</i>	20	16	1 0	11	„	Thrives fairly well.
<i>Cedrus atlantica</i>	18	15	0 9	9	„	„ „
<i>Cupressus Lawsoniana</i> ...	18	25	2 5	11	„	Fine healthy tree.
<i>Thuja gigantea</i>	20	30	2 4	9	„	„ „ grows fast.
<i>Wellingtonia gigantea</i> ...	20	30	2 4	8	„	Fine specimen.

GENERAL REMARKS.—The hardier species of Conifers thrive well on the estates of Langholm and Canonbie. Those that take kindly to the soil and climate of the district are very promising, and form a pleasing addition to the landscape. *Abies Albertiana* thrives well, and is very much admired. *A. Douglasii* is one of the very best of the newer Conifers, and makes wood rapidly in well sheltered places; but it will not do in situations exposed to cutting winds and spring frosts. *A. nobilis* also does well, and is among the best of Conifers, having a fine habit and a very rich colour. The Crimean Fir, *A. Nordmanniana*, does not do well here—at least, the smaller-leaved variety, some of which sicken and die off almost every year, but the large-leaved kind does fairly well. All the hardy Cypresses do very well, grow fast and vigorous, and promise to make fine evergreen trees. *Thuja gigantea* (or *Lobbii*) grows fast, and promises to do very well, although in late springs some of the young shoots seem to get frosted or browned. *Thuyopsis borealis* is a very beautiful and hardy Conifer. *Wellingtonia gigantea* is handsome, but must be well sheltered from cold cutting winds. The Austrian Pine is very valuable for planting on exposed places, and grows rapidly. The Corsican Pine also grows fast, but is very subject to be blown over when young, owing to its sparse-rooting nature and rather “leggy” habit. In my opinion, none of the newer Conifers have yet proved equal to the Larch, Scots Pine, Silver Fir, and Spruce as forest or timber-producing trees. Spruce is very much underrated with us. While it is young and under 40 to 50 years of age, it makes wood faster, and is superior to Scots Pine for fencing and other country purposes, until the Scots Pine gets old and matured, which takes more than an average lifetime. However, the young Scots Pine is preferred in the mines to Spruce, for pit props. We are expecting good results from the naphthalising of Spruce wood—to make it more durable for fencing, &c.—which is now on its trial here, and promises success. Next to the Larch, Silver Fir is the most durable coniferous wood we grow, and ought to be much more extensively planted. The newer species of Conifers are very interesting and beautiful, and a great addition to the pleasing effect of our lawns and ornamental grounds, and some of them may yet prove useful for timber when they reach maturity and time has fully developed and tested their various qualities.

EAST LOTHIAN.

SALTOUN HALL. JOHN FLETCHER, Esq.

Correspondent: Mr. MALCOLM McLEAN, The Gardens, Saltoun Hall, Pencaitland.

Abies balsamea. A very fine and well-furnished specimen of the Balsam Fir, which was much valued by the proprietor, stood on this estate till it was swept

away by the great flood in the Tyne in September 1891. It grew in a deep rich soil, and well-sheltered spot on the banks of the river Tyne, at an altitude of about 80 feet; and had attained considerable dimensions, as the following figures show:

Height of tree 68 feet; lost its top previously.					
Girth of stem at 1 foot from ground, 9 ft. 8 in.					
"	"	10 feet	"	7	10
"	"	20 "	"	7	2
"	"	30 "	"	6	4
"	"	40 "	"	5	3
"	"	50 "	"	4	5
"	"	60 "	"	3	6

The tree had lost its top, but in all other respects was well balanced and handsome, and growing vigorously, when it was unfortunately overwhelmed and carried down the river fully a mile by the heavy flood. The seed from which the tree was raised is supposed to have been given by Bishop Compton, of London, who introduced the Balsam Fir from North America in 1697, to Bishop Burnet, who was long resident at Saltoun, and was incumbent of the parish for some years.

WHITTINGHAME. ARTHUR JAMES BALFOUR, Esq.

Altitude, about 350 feet. Soil, red loam; subsoil, sandy gravel.

Correspondent: JOHN GARRETT, The Gardens, Whittinghame, Prestonkirk.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	6	7	—	—	S.	Very promising.
" <i>cephalonica</i>	45	55	8 0	30	S.W.	Fine specimen.
" <i>concolor</i>	6	5	—	—	S.	Very healthy.
" <i>Douglasii</i>	45	60	6 9	40	"	Fine tree.
" <i>grandis</i>	5	7	—	—	"	Very healthy.
" <i>magnifica</i>	5	6	—	—	"	"
" <i>Menziesii</i>	25	44	3 4	20	"	Vigorous.
" <i>Morinda</i>	35	55	3 4	18	"	Handsome tree.
" <i>nobilis</i>	45	72	5 10	27	W.	Vigorous; grand tree.
" <i>Nordmanniana</i> ...	45	68	6 1	30	"	Beautifully shaped tree.
" <i>Pinsapo</i>	35	42	2 7	27	"	Fine specimen.
" <i>Webbiana</i>	45	45	4 8	29	S.	"
<i>Araucaria imbricata</i> ...	45	43	5 1	18	S.	"
<i>Cedrus atlantica</i>	45	59	6 6	30	"	Vigorous; fine tree.
" <i>Deodara</i>	45	44	8 0	42	Open	"
<i>Cryptomeria japonica</i> ...	30	30	4 5	18	W.	Healthy; beautiful.
<i>Cupressus Lawsoniana</i>	33	42	3 0	12	"	Fine handsome tree.
" <i>macrocarpa</i> ...	35	45	4 9	39	S.	"
<i>Pinus austriaca</i>	45	51	6 9	32	"	Healthy; branching tree.
" <i>Cembra</i>	45	44	3 8	13	"	Fine specimen.
" <i>excelsa</i>	35	45	4 6	20	"	"
" <i>insignis</i>	6	7	—	—	W.	Very healthy.
" <i>Laricio</i>	35	45	3 0	14	S.W.	Healthy; coarse.
" <i>ponderosa</i>	45	50	4 6	18	W.	Vigorous.
<i>Taxodium sempervirens</i>	30	49	4 9	24	S.W.	" well sheltered.
<i>Thuja gigantea</i>	25	40	3 1	20	S.E.	Handsome tree.
<i>Thuyopsis borealis</i>	30	36	2 6	9	W.	"
<i>Wellingtonia gigantea</i>	34	64	7 9	18	"	Very fine handsome tree.

GENERAL REMARKS.—Most kinds of hardy Conifers do well on our warm red loam, resting on an open gravelly subsoil overlying red sandstone. The ages given of the older specimens are only approximate, but as near as can be found out. The *Araucaria* bore about 120 cones this season, containing seeds which have ripened and, we hope, will produce young trees.

FIFESHIRE.

FORDELL. Hon. H. H. DUNCAN.

Altitude, 200 feet. Soil, a free loam; subsoil, open till.

Correspondent: Mr. GEORGE RAMSAY, The Gardens, Fordell, Inverkeening.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	35	50	4 9	33	W.	Luxuriant; very fine tree.
" <i>cephalonica</i>	35	50	4 6	24	"	Vigorous tree.
" <i>concolor</i>	10	12	1 0	8	"	Very healthy & promising.
" <i>Lowiana</i>	35	55	4 0	30	"	Very handsome tree.
" <i>Douglasii</i>	35	60	5 0	28	"	Planted extensively; doing well.
" <i>grandis</i>	30	40	3 6	18	"	Thriving well.
" <i>Menziesii</i>	35	45	3 0	23	"	Fine specimen.
" <i>nobilis</i>	20	30	2 6	18	"	Fine thrivingspecimens.
" <i>Nordmanniana</i> ...	35	40	3 0	26	"	Hundreds thriving well.
<i>Araucaria imbricata</i> ...	45	40	3 6	20	"	Many well furnished trees.
<i>Cedrus atlantica</i>	35	45	3 6	28	"	{ Many fine trees; two acres, planted 25 years, doing well.
" <i>Deodara</i>	35	35	2 6	20	"	
<i>Cryptomeria japonica</i> ...	30	40	1 9	20	"	Fine healthy tree.
<i>Cupressus Lawsoniana</i>	30	36	2 6	12	"	Planted extensively; growing remarkably well.
<i>Libocedrus decurrens</i> ...	35	25	3 0	8	"	Fine specimen.
<i>Pinus austriaca</i>	35	40	3 0	18	"	Doing fairly well.
" <i>Cembra</i>	35	35	2 4	12	"	Very fine specimens.
" <i>excelsa</i>	35	40	3 0	20	"	Fine when young, does not stand the wind.
" <i>Jeffreyi</i>	35	50	3 6	15	"	Doing fairly well.
" <i>Laricio</i>	15	25	2 0	12	"	Doing very well.
" <i>ponderosa</i>	35	48	3 0	15	"	Doing fairly well.
<i>Taxodium sempervirens</i>	35	45	7 0	22	"	Very fine specimens.
<i>Thuja gigantea</i>	35	45	2 6	12	"	Handsome specimens.
<i>Thuyopsis borealis</i>	35	30	1 9	9	"	Many graceful trees.
<i>Wellingtonia gigantea</i>	35	55	7 6	18	"	Thriving well; handsome.

GENERAL REMARKS.—The Conifers, as a rule, thrive remarkably well here, but scarcely receive the attention they deserve, and many leaders have been damaged or lost by storms, shooting, squirrels, &c. *Abies Douglasii*, *A. Nordmanniana*, *A. nobilis*, Cedars, Lawson's Cypress, *Thuja gigantea*, *Wellingtonias*,

and others were planted in the young woods of Scots' Fir about 18 years ago, and, with the shelter afforded by the Firs, they have grown vigorously and form fine trees. Within the past few years many thousands have been planted out from the home nursery, and are already growing fast and promising to do as well as the older trees.

KILMARON CASTLE. EDWARD A. BAXTER, Esq.

Altitude, 250 feet. Soil, heavy loam; subsoil, rocky.

Correspondent: Mr. WILLIAM BROW, The Gardens, Kilmaron, Cupar.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	26	45	3 9	25	S.	Handsome tree.
„ <i>concolor</i>	26	42	4 5	21	„	„
„ <i>Douglasii</i>	26	53	6 0	31	„	Growing vigorously, fine.
„ <i>grandis</i>	24	45	4 4	32	„	„
„ <i>nobilis</i>	25	46	3 2	21	„	„
„ <i>Nordmanniana</i> ...	24	45	2 7½	18	„	„
<i>Araucaria imbricata</i> ...	22	32	3 5	21	„	Very fine specimen.
<i>Cedrus Deodara</i>	33	37	5 4	33	„	„
<i>Cupressus Lawsoniana</i>	26	33	3 6	11	„	„
<i>Libocedrus decurrens</i> ...	23	23	3 6	7	„	Fine specimen.
<i>Pinus austriaca</i>	25	34	3 11	24	„	„
„ <i>Cembra</i>	24	28	2 1	6	„	„
„ <i>excelsa</i>	33	42	4 6	27	„	„
„ <i>Jeffreyi</i>	26	40	3 9	16	„	Vigorous.
„ <i>ponderosa</i>	26	40	4 4	21	„	„
<i>Taxodium sempervirens</i>	26	45	5 9	27	„	Very fine tree.
<i>Thuja gigantea</i>	23	23	3 6	7	„	Fine specimen.
<i>Thuyopsis borealis</i>	26	27	—	12	„	Fine feathery specimen.
<i>Wellingtonia gigantea</i>	26	51	7 4	—	„	Very fine tree.

GENERAL REMARKS.—The Conifers here are growing on a southern slope, well sheltered from the north and west. They have all been planted by myself, and generally speaking are healthy and thriving, particularly those noted in the above list.

FORFARSHIRE.

GLAMIS CASTLE. EARL OF STRATHMORE.

Altitude, 150 feet. Soil, a medium loam; subsoil, clay and gravel.

Correspondent: Mr. JAMES WHITTON, The Gardens, Glamis Castle, Forfar.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	52	3 9	26	E.	Handsome tree.
„ <i>concolor</i>	30	39	4 2	16	„	Fine specimen.
„ <i>Douglasii</i>	27	47	4 0	23	S.	Dense, fine specimen.
„ <i>grandis</i>	27	41	4 0	23	„	Beautiful specimen.
„ <i>magnifica</i>	30	27	3 3	11	„	Handsome tree.
„ <i>Menziesii</i>	30	44	4 9	26	„	Fine specimen.
„ <i>nobilis</i>	30	47	4 10	25	W.	Fine glaucous variety.
„ <i>Nordmanniana</i> ...	30	25	2 7	15	S.	Dense habit; fine tree.
„ <i>orientalis</i>	30	38	4 6	20	„	Handsome tree.
<i>Araucaria imbricata</i> ...	30	30	3 6	21	„	Fine specimen.
<i>Cedrus atlantica</i>	30	40	3 6	16	„	„
„ <i>Deodara</i>	30	19	2 0	11	E.	Not thriving.
<i>Cupressus Lawsoniana</i>	30	30	4 0	12	S.E.	Fine healthy specimen.
<i>Libocedrus decurrens</i> ...	30	20	2 4	6	S.	A nice specimen.
<i>Pinus austriaca</i>	30	24	3 0	16	„	Dense bushy tree.
„ <i>Laricio</i>	30	31	2 6	8	„	A fairly good tree.
„ <i>ponderosa</i>	30	28	3 2	10	W.	„
„ <i>pyrenaica</i>	30	32	3 0	18	S.	A fine tree.
<i>Thuja gigantea</i>	30	42	3 2	14	W.	Very handsome tree.
<i>Thuyopsis borealis</i>	30	27	2 0	13	S.W.	Beautiful specimen.
<i>Wellingtonia gigantea</i>	30	27	3 3	12	W.	Moderate specimen.

GENERAL REMARKS.—The ages given above are calculated from the year the plants were raised from seed. They have all been planted out here since the year 1865, or within the past twenty-six years. The greater portion of them were planted between 1868 and 1870, and I assisted at planting the *Abies Douglasii* and *A. grandis* in 1871. In regard to the growth and characteristics of the best of the Conifers here, I may state that *Abies Douglasii* is the one which has been planted in the greatest quantity, and which does remarkably well. Whether it is the superior strain of Douglas Fir that has been used, or the soil in which they grow, I cannot tell; but they have a more compact and neater habit altogether than we are accustomed to see in most other places. It is quite likely the soil has something to do with it; a free loam, resting on a cool open subsoil. I measured many trees of it higher and thicker than the one of which the details are given, but I consider it the best furnished specimen. *A. grandis* also thrives exceedingly well, and there are many trees of about the same size as the one noted. *A. Albertiana* is another of the successful Conifers here, of which there are many nice trees. *A. nobilis* is a favourite tree here, and numerous planted; but the leader grows so strong and is so brittle that it is very often broken, and few of the specimens have escaped injury in this way, or form perfect specimens. There are some very nice specimens of *A. magnifica*, a very handsome Conifer when it is perfect, but its vigorous leader suffers in the same way as its congener *A. nobilis*. Among the hardiest and strongest growers is *A. Menziesii*, which does very well indeed, and nothing seems to affect it. It is not so, however, with that handsome Fir, *A. Nordmanniana*, which within the past few years has been so severely attacked by the Silver Fir Bug that it is fast

ruining them, and many of the trees, both large and small, have been destroyed in trying to get rid of it. *A. concolor*, *lasiocarpa* or *Lowii*, is another beautiful Fir which thrives well here, and there are many fine specimens, although several of the older trees have been somewhat disfigured by the loss of their leaders. Of that doubtful and vexing species, *A. amabilis* of Douglas, there are several plants, none of which, however, I would venture to guarantee; but there is a nice specimen at the village schoolhouse which answers the description in Veitch's *Manual*, and which the planter (the late Mr. Ross, teacher) assured me was genuine. I may say that it was a treat to spend an hour with Mr. Ross, discoursing on plants in general, and Conifers in particular. He was a great enthusiast among the latter, as his work still shows; the tallest and thickest-stemmed *Wellingtonia* in the parish being there, as well as the finest variegated one in the county, besides many other choice and rare Conifers. *Araucarias* have not been a success here, and very few are planted. Cedars also have been but sparsely planted and grow slowly, but they are fairly healthy, and by 1991 they may be the ornament of the place. The Pines do moderately well, but there have not been many varieties planted. *Pinus austriaca* grows freely, but more in a bush than a tree form, and makes good shelter. *P. Cembra* and *P. pyrenaica* both do well and form nice trees; but *P. Laricio* is scrubby, *P. Jeffreyi* rather stunted, and *P. ponderosa* and *P. Benthamiana*, which appear to be the same, are doing tolerably well. Of the class of smaller ornamental Conifers there is not a great variety; but *Cupressus Lawsoniana*, *Thuja gigantea*, and *Thuyopsis borealis* are grown in quantity and are thriving beautifully. *Wellingtonia gigantea* does not do very well as a rule, and at its best the growth is slow and the foliage thin, not at all characteristic of the tree.

KINNETTLES. JOSEPH GRIMOND, Esq.

Altitude, 130 feet. Soil, strong loam; subsoil, clay.

Correspondent: Mr. DAVID BLYTH, The Gardens, Kinnettles, Forfar.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	34	1 6	18	S.W.	Fine healthy tree.
„ <i>bracteata</i>	20	21	1 1	16	„	Unique in district.
„ <i>concolor</i>	32	50	4 0	20	„	Very fine specimen.
„ <i>Douglasii</i>	32	72	4 8	36	„	„ „
„ <i>grandis</i>	32	65	5 0	28	„	„ „
„ <i>magnifica</i>	16	28	2 0	10	„	Handsome tree.
„ <i>Menziesii</i>	26	65	3 9	24	„	Vigorous grower.
„ <i>nobilis</i>	16	32	2 6	11	„	„ „
„ <i>Nordmanniana</i>	16	30	2 6	18	„	Fine specimen.
„ <i>polita</i>	16	15	1 6	12	„	Nice healthy tree.
<i>Araucaria imbricata</i>	32	30	2 6	16	„	Fine specimen.
<i>Cedrus atlantica</i>	32	26	3 0	11	„	„ „
<i>Pinus excelsa</i>	20	20	1 6	16	„	Fair specimen.
<i>Wellingtonia gigantea</i> ...	32	44	9 6	20	„	Very fine specimen.
„ „ <i>variegata</i>	20	14	1 3	11	„	„ „

GENERAL REMARKS.—The newer Conifers grow well on the strong soil here, resting on an open clayey subsoil, with the ground sloping rather steeply to the south-west. Besides those of which the dimensions are given, there are many fine trees of the same and other species, particularly *Cupressus Lawsoniana*, *Thuja gigantea*, and *Thuyopsis borealis*, which all grow vigorously and form very handsome specimens.

KINCARDINESHIRE.

DURRIS. T. GRAHAM YOUNG, Esq.

Altitude, 100 to 200 feet. Soil, dark loam; subsoil, open clay.

Correspondent: Mr. ALEXR. LAWSON, Forester, Durris Estate, Aberdeen.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	—	50	3 9	26	N.W.	Every tree healthy.
„ <i>concolor</i>	—	38	4 11	18	„	„ „
„ <i>Douglasii</i>	—	90	10 3	50	„	Thrives very well.
„ <i>grandis</i>	—	50	5 7	28	„	„ „
„ <i>magnifica</i>	—	45	4 2	15	„	„ „
„ <i>Menziesii</i>	—	50	3 11	26	„	Won't stand crowding.
„ <i>nobilis</i>	—	45	5 8	28	„	Requires perfect drainage.
„ <i>Nordmanniana</i> ...	—	40	3 3	22	„	Liable to "bug."
<i>Araucaria imbricata</i> ...	—	30	3 10	21	„	Bearing cones.
<i>Cedrus Deodara</i>	—	30	3 8	25	„	Thrives fairly well.
<i>Cupressus Lawsoniana</i>	—	30	2 10	16	„	Thrives very well.
<i>Pinus Cembra</i>	—	35	3 8	15	„	„ „
<i>Wellingtonia gigantea</i>	—	37	7 9	22	„	„ „
„ „ <i>variegata</i>	—	14	1 6	8	„	„ „

GENERAL REMARKS.—Large numbers of hardy Conifers are planted in the policies here, which cover 200 acres, and most of them are thriving very well. *Cedrus atlantica* and the more tender Pines, &c., do not succeed, but all those mentioned in the list, and some others, grow luxuriantly, and make remarkably fine growth every season. An avenue, a mile long, is planted with *Abies nobilis* and Birch, Lime, or Chestnut alternately, and the effect is very fine.

KIRKCUDBRIGHTSHIRE.

MUNCHES. WELLWOOD H. MAXWELL, Esq.

Altitude, 20 to 50 feet. Soil, heavy loam, light loam, and peat; subsoil, clay, gravel and rock.

Correspondent: WELLWOOD H. MAXWELL, Esq., of Munches, Dalbeattie.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	25	69	4 3	20	S.E.	Vigorous.
„ <i>concolor</i>	25	54	4 7	20	„	„
„ <i>Douglasii</i>	35	53	5 6	30	„	Healthy.
„ <i>grandis</i>	30	50	4 7	25	„	Vigorous.
„ <i>magnifica</i>	20	27	2 0	9	„	„
„ <i>Menziesii</i>	35	64	8 2	30	„	„
„ <i>nobilis</i>	20	40	2 9	16	„	„
„ <i>Nordmanniana</i> ...	20	48	3 6	15	„	„
<i>Araucaria imbricata</i> ...	35	35	2 5	14	„	Healthy.
<i>Cedrus Deodara</i>	25	30	4 1	13	„	Not doing well.
<i>Cupressus Lawsoniana</i>	30	38	3 1	10	„	Vigorous.
<i>Pinus Cembra</i>	25	40	4 3	14	„	„
„ <i>excelsa</i>	30	60	6 1	23	„	„
„ <i>Laricio</i>	25	45	3 0	—	„	„
<i>Thuja gigantea</i>	30	59	3 11	16	„	Very fast growing.
<i>Thuyopsis borealis</i>	25	33	2 2	20	„	Very graceful.
<i>Wellingtonia gigantea</i>	25	40	9 4	30	„	Vigorous.

GENERAL REMARKS.—The ages are as near the time the trees have been planted as possible, and generally small plants were used. The spread of branches depends greatly on the situation, and whether they are crowded by other trees or not. All that are named above are thriving vigorously, except the *Deodar*, many of which, growing on a dry hillside, are fast failing. Most of the specimens of which the measurements are given grow at an altitude under 50 feet above sea-level, and are well sheltered; but many fine younger trees of most of them are thriving remarkably well on the hillsides adjoining, at an altitude of several hundred feet. The Scots Fir is indigenous, and a number of fine old natural trees of it are growing in the woods and policies. The *Araucaria* in the list is the only one which survived the severe frost of the winter 1860–61, and has thriven very well since. *Taxodium sempervirens* does not succeed here, although some very healthy specimens are growing in the neighbourhood.

LANARKSHIRE.

DOLPHINTON. JOHN ORD MACKENZIE, Esq.

Altitude, 800 to 850 feet. Soil, a free loam; subsoil, open, gravelly.

Correspondent: JOHN ORD MACKENZIE, Esq., W.S., of Dolphinton.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	27	55	3 6	28	S.E.	Vigorous, very promising.
„ <i>Alcoquiana</i>	10	14	—	8	„	Pretty, promising; hardy.
„ <i>cephalonica</i>	18	37	2 7	17	„	Requires a sheltered site.
„ <i>Douglasii</i>	41	62	7 6	36	„	Very promising in shelter.
„ <i>grandis</i>	20	68	5 5	32	„	Promising and desirable.
„ <i>lasiocarpa</i>	30	40 $\frac{1}{2}$	4 0	19	„	Very promising tree.
„ <i>magnifica</i>	15	28	2 4	11	N.	A pretty tree; very hardy.
„ <i>Menziesii</i>	30	60	5 6	30	S.E.	Vigorous and fast growing.
„ <i>nobilis</i>	30	57 $\frac{1}{2}$	4 9	26	„	Very thriving; a fine tree.
„ <i>Nordmanniana</i> ..	30	50	3 10	18	„	Very handsome specimens.
„ <i>orientalis</i>	15	32	2 9	15	„	Close habited & effective.
<i>Araucaria imbricata</i> ..	40	28	2 5	17	W.	More curious than pretty.
<i>Cupressus Lawsoniana</i>	28	29	2 4	15	...	Thrives everywhere.
<i>Pinus Laricio</i>	35	36	3 6	15	S.W.	Vigorous and hardy.
<i>Thuja gigantea</i>	20	21	—	7	„	(<i>Taxocedrus decurrens</i>).
„ <i>Lobbii</i>	18	41	2 4	15	S	(<i>Thuja gigantea</i>) vigorous.
<i>Thuyopsis borealis</i>	—	25	1 8	12	S.W.	Very hardy and graceful.
<i>Wellingtonia gigantea</i>	25	32	5 6	15	S.	More curious than pretty.

GENERAL REMARKS.—All the Conifers named in the list thrive well at this high altitude. Of *Abies Albertiana* there are numerous promising trees, which have been raised from seed ripened at Carstairs, in this county, and at Scone Palace, near Perth. *Abies Douglasii*, *A. grandis*, and *A. lasiocarpa* are thrifty and desirable trees. *Abies magnifica* does not show young growth till near Midsummer, and is thus safe from frost. The lower branches of *A. Menziesii* were damaged last winter, though it is a vigorous and generally hardy tree. Of many fine trees of *A. nobilis*, none are bearing cones this year; some thriving young trees of it were raised from seed ripened at Scone. *A. Nordmanniana* forms a very handsome tree, but signs of disease are appearing among them. A few plants of *Araucaria imbricata* were raised from seed ripened at Strathfieldsaye, Hants, and are healthy and promising. *Cupressus Lawsoniana* is a great acquisition, thriving under almost any treatment if fairly sheltered, and from its drooping branches the snow readily falls off, which it does not do from the common hardy *Arborvitae*, a fine specimen of which, of twenty years' growth, was torn to pieces here by a heavy fall of snow. *Pinus Laricio* is apt to get wind-bound and stunted in early life, but afterwards recovers and grows freely. *Thuja gigantea*, *Lobbii*, or *Menziesii* is a hardy and very desirable tree. *Thuyopsis borealis* is one of the hardiest and most graceful of all the coniferous tribe, and thrives everywhere, although when exposed to strong winds it is apt to grow bushy and out of shape. Of *Abies alba*, *A. nigra*, and *A. picea* there are many specimens which enjoy greater immunity from hares and rabbits than other more valuable varieties seem to possess, but in other respects they are inferior. *Abies Pinsapo* exists, but it does not thrive well, and seldom makes a good leader. *Pinus austriaca* and *P. Cembra* are not thriving well; and *Cedrus atlantica*, *C. Deodara*, *Pinus excelsa*, *P. insignis*, *P. monticola*, *P. ponderosa*, and *Taxodium sempervirens* have all been tried and failed, some of them failing after growing well for ten or twelve years.

MIDLOTHIAN.

DALKEITH. DUKE OF BUCCLEUCH.

Altitude, 150 to 200 feet. Soil, light loam; subsoil, gravelly.

Correspondent: Mr. MALCOLM DUNN, The Gardens, Dalkeith.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies canadensis</i>	80	42	10 6	44	N.W.	Fine tree; girth at 2 ft. up.
„ <i>cephalonica</i>	35	40	4 2	22	N.	Moderate grower.
„ <i>concolor</i>	12	15	1 2 $\frac{1}{2}$	10	S.E.	„ „ fine species.
„ <i>Douglasii</i>	35	71	4 6	52	N.	Vigorous.
„ <i>grandis</i>	20	38	3 2	18	„	„
„ <i>nobilis</i>	18	25	3 0	16	S.	„
„ <i>Nordmanniana</i>	30	35	2 10 $\frac{1}{2}$	20	„	„
<i>Araucaria imbricata</i> ...	30	30	2 6 $\frac{1}{2}$	22	S.E.	„
<i>Biota orientalis aurea</i> ...	30	6	—	7	S.	Very ornamental.
<i>Cedrus atlantica</i>	35	36	3 8 $\frac{1}{2}$	30	„	Free growing; exposed.
„ <i>Deodara</i>	35	38	6 6	34	S.E.	Handsome tree; sheltered.
„ <i>Libani</i>	120	74	13 2	84	S.	Fine old tree; well sheltered.
<i>Cryptomeria japonica</i> ...	30	25	1 8	12	N.	Healthy; top exposed.
<i>Cupressus Lawsoniana</i>	30	32	3 0	10	„	Handsome specimen.
„ <i>macrocarpa</i>	30	48	5 0	22	S.E.	Vigorous, & fast growing.
„ <i>torulosa</i> ...	20	11	1 2	3	S.	Nice small tree.
<i>Juniperus sinensis</i>	25	16	1 1	4	„	„
<i>Pinus Cembra</i>	30	29	1 11	14	N.	Slow growing; healthy.
„ <i>excelsa</i>	30	35	3 10	20	S.E.	Not very suitable.
„ <i>Jeffreyi</i>	20	19	1 10	18	N.	Slow grow'g; very healthy.
„ <i>monticola</i>	20	27	2 2	16	S.	Healthy; free grower.
„ <i>ponderosa</i>	30	35	2 10	18	N.	„ „
<i>Retinospora plumosa</i>						
„ <i>aurea</i>	18	12	1 3	8	S.	Very beautiful.
<i>Salisburia adiantifolia</i>	40	48 $\frac{1}{2}$	4 2	25	„	Fine healthy tree.
<i>Sciadopitys verticillata</i>	12	6	—	4	„	Very interesting.
<i>Taxus adpressa</i>	30	10	—	24	S.E.	Fine specimen.
„ <i>baccata</i>	150	48	9 8	62	„	Large and healthy tree.
„ „ <i>aurea</i>	30	8	—	20	„	Very ornamental.
„ „ <i>Dovastonii</i>	30	6	—	22	N.	Fine specimen.
„ „ <i>fastigiata</i>	80	22	—	12	„	„
<i>Thuja gigantea</i>	18	30	1 9	10	S.E.	Free growing.
„ <i>Standishii</i>	18	15	1 0	7	S.	A nice small tree.
<i>Thuyopsis borealis</i>	30	28	—	12	„	Beautiful and shapely tree.
„ „ <i>variegata</i>	10	12	—	8	„	„ variety.
<i>Wellingtonia gigantea</i>	32	42	5 4	20	S.E.	Good specimen; top exposed.
„ „ <i>pendula</i>	15	13 $\frac{1}{2}$	1 0	1	„	A very distinct variety.

GENERAL REMARKS.—The deep light soil and rather dry climate of this district suit some Conifers admirably, while others do not thrive so well as they do

in cooler soils and moister localities. The *Araucaria*, Cedars, Cyresses, Thuyas, Wellingtonia, and Yews all thrive well, and many of them have grown into fine specimens, although the growth is not so luxuriant as a moist climate produces. Generally speaking, Firs, Pines, and Spruces thrive fairly well for a time, but the aridity of the soil and atmosphere ultimately tells its tale, and the trees become ragged and unsightly, especially where they are exposed to the blast. The best Conifer for withstanding the blast here is *Araucaria imbricata*, which in the most exposed sites shows no sign of being wind-swept, and appears to thrive best in open airy spots. Most of the hardy Conifers of Japan do well, and in course of time they will make effective ornamental specimens. The Maidenhair tree grows freely, and its characteristic foliage is always effective and interesting. Golden and variegated Conifers—such as Yews, Cyresses, *Retinosporas*, and the like—thrive well, and assume in the season their richest colours.

MORTON HALL. Colonel HENRY TROTTER.

Altitude, 450 feet. Soil, peaty and stiff loam; subsoil, sour wet clay.

Correspondent: Mr. D. F. MACKENZIE, Factor, Morton Hall, Liberton.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies cephalonica</i>	32	36	4 2	20	Sheld	Soil unsuitable.
„ <i>grandis</i>	32	40	3 3	21	„	„
„ <i>Menziesii</i>	32	65	6 3	36	„	Does very well; fine tree.
„ <i>Morinda</i>	32	40	2 11	14	„	Handsome specimen.
„ <i>nobilis</i>	32	67	4 4	18	„	Fine tree; lost leader two years ago.
<i>Pinus austriaca</i>	32	20	4 7	30	„	Rough bushy tree
„ <i>Cembra</i>	32	37	3 8	17	„	„
„ <i>Laricio</i>	44	54	4 7	9	„	Plantation tree; crowded.

GENERAL REMARKS.—All these trees, except *Pinus Laricio*, are growing in the pleasure grounds here, close to, but generally clear of, each other. *Cryptomerias*, *Taxodiums*, and *Wellingtonia* are not thriving well in the wet “sour” soil. Young trees of *Cupressus Lawsoniana*, seven years planted, are 12 feet high; and of *Thuya gigantea*, nine years planted, 18 feet high; both thriving well and very promising.

OXENFORD CASTLE. EARL OF STAIR.

Altitude, 250 feet. Soil, heavy and light loam; subsoil, clay and gravel.

Correspondent : Mr. WILLIAM SMITH, The Gardens, Oxenford Castle, Dalkeith.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies concolor</i>	30	40	2 9	16	S.E.	Fine specimen.
„ <i>Douglasii glauca</i>	40	60	3 4	21	„	Drooping habit. Beautiful specimen.
„ <i>grandis</i>	35	60	3 9	27	„	Handsome tree.
„ <i>Hookeriana</i>	20	25	1 10	11	„	Beautiful tree.
„ <i>Menziesii</i>	30	60	4 9	23	„	Vigorous & free-growing.
„ <i>nobilis</i>	34	55	4 8	26	„	„ fine tree.
„ <i>Nordmanniana</i>	30	45	2 3	17	„	Handsome tree.
„ <i>orientalis</i>	40	40	3 0	17	„	„
<i>Araucaria imbricata</i>	40	48	3 10	22	„	Fine specimen.
<i>Cupressus Lawsoniana</i>	35	45	4 0	19	„	Very fine and vigorous.
<i>Libocedrus decurrens</i>	30	30	3 9	6	„	Fine specimen.
<i>Pinus austriaca</i>	30	35	4 0	—	„	Plantation tree.
„ <i>Cembra</i>	30	30	2 1	14	„	Fine specimen.
„ <i>Jeffreyi</i>	30	40	2 9	—	„	Irregular.
„ <i>Laricio</i>	35	45	3 10	—	„	Coarse and irregular.
<i>Taxodium sempervirens</i>	45	48	5 0	19	„	Good specimen.
<i>Thuja gigantea</i>	35	45	4 0	14	„	Vigorous & free-growing.
<i>Thuyopsis borealis</i>	30	36	—	11	„	Beautifully healthy tree.
<i>Wellingtonia gigantea</i>	35	42	6 0	18	„	Handsome specimen.

GENERAL REMARKS.—The above are the finest specimens of their kind among a large number here. On the heavy soil, which predominates, Firs, Pines, and Spruces thrive best; while on the lighter loam Cypress, Thuja, and Wellingtonia do well. A fine avenue in the grounds is formed of *Abies nobilis glauca* and *Wellingtonia gigantea*, planted alternately, which has a very pleasing effect.

RICCARTON. SIR JAMES H. GIBSON CRAIG, Bart.

Altitude, 300 feet Soil, loam; subsoil, hard blue "pan."

Correspondent: SIR JAMES H. GIBSON CRAIG, Bart., of Riccarton.

Botanical Name	Age	Height	Girth at 5ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i> (1)	—	55	4 1 $\frac{1}{2}$	30	S.	Hardy & free growing.
" " (2)	—	68 $\frac{1}{2}$	3 2 $\frac{1}{2}$	26	E.	"
" <i>Douglasii</i>	—	—	7 10	40	"	Lost its top; vigorous.
" <i>grandis</i>	—	83 $\frac{1}{4}$	3 8 $\frac{1}{2}$	30	"	Very vigorous.
" <i>nobilis</i>	—	49	5 2	35	S.	Lost top 15 years ago. Formed another and lost it. Not healthy.
" <i>Nordmanniana</i>	—	65	3 2 $\frac{1}{2}$	24	S.E.	Handsome tree.
<i>Araucaria imbricata</i>	—	35 $\frac{1}{2}$	3 0	19	E.	"
<i>Cryptomeria japonica</i> (1)	—	28 $\frac{1}{2}$	3 6 $\frac{1}{2}$	16	S.	{ Growing within 30 yds. of each other, under similar conditions.
" " (2)	—	43 $\frac{1}{2}$	2 8	13	"	
<i>Pinus Laricio</i>	—	69	7 7 $\frac{1}{2}$	47	"	Fine tree.
<i>Taxodium sempervirens</i> (1)	—	48	4 2 $\frac{1}{2}$	19	W.	Fine specimen.
" " (2)	—	43	5 8	26	E.	"
<i>Thuja Craigiana</i>	28	41	4 3	17	S.	Handsome, free growing.
" <i>Lobbii</i>	—	56 $\frac{1}{2}$	3 10	11	E.	Vigorous.
<i>Wellingtonia gigantea</i> (1)	36	54	5 9	14	"	"
" " (2)	36	53	5 8 $\frac{1}{2}$	18	"	"
" " (3)	26	45	5 10	17	S.	"

GENERAL REMARKS.—The soil is a good free loam, and the subsoil generally a hard blue pan. Conifers of most kinds thrive well, and some are making extra fine growth. The specimen of *Abies grandis* given in the table has made the following growth in recent years:—

Growth in last 7 years 30 feet 4 inches.

" " " 10 " 43 " 6 "

" " " 12 " 53 "

Another *Abies grandis*, about 55 feet high, has grown 21 feet 6 inches in five years. A corner in an old wood was blown out in 1865, and in 1866 it was replanted. The *Abies grandis* now run from 58 to 66 feet, and the other Conifers, including *A. Albertiana*, *Cupressus Lawsoniana*, *Thuja Lobbii*, &c., are also good in proportion. This is interesting, as showing how the new Coniferæ will thrive after old woods have occupied the ground for many years.

MORAYSHIRE.

ALTYRE. SIR WM. G. GORDON CUMMING, Bart.

Altitude, 60 to 100 feet. Soil, light loam; subsoil, open gravel.

Correspondent: Mr. WILLIAM McLAREN, Forester, Altyre, Forres.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	30	80	6 0	45	N.E.	Vigorous.
„ <i>grandis</i>	22	60	7 0	30	„	Healthy; free growing.
„ <i>Nordmanniana</i> ...	22	45	4 6	27	„	Vigorous.
<i>Pinus austriaca</i>	22	35	4 8	—	„	„
„ <i>Laricio</i>	22	40	3 10	—	„	„
„ <i>monticola</i>	22	60	3 10	—	„	„
<i>Wellingtonia gigantea</i>	25	50	7 3	18	„	„

GENERAL REMARKS.—Besides the above, the following Conifers are growing vigorously here: *Abies Albertiana*, *A. magnifica*, *A. Morinda*, *A. nobilis*, *A. Pinsapo*, *Araucaria imbricata*, *Pinus Cembra*, *Thuopsis borealis*, and *T. dolabrata*. *Abies lasiocarpa*, *A. Menziesii*, *A. orientalis*, *A. Webbiana*, *Cryptomeria japonica*, *Cupressus Lambertiana*, *C. Lawsoniana*, and *Thuja Lobbii* are healthy, and make moderate growth. They are all growing in a gravelly soil, and a well-sheltered situation.

BRODIE CASTLE. BRODIE OF BRODIE.

Altitude, 50 feet. Soil, light; subsoil, gravelly.

Correspondent: JAMES MCKENDRICK, Forester, Brodie Castle, Forres.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	50	80	6 2	35	Sheldt.	Splendid tree.
„ <i>grandis</i>	30	50	4 6	—	„	Growing in clump; vigor.
„ <i>Menziesii</i>	50	80	8 4	45	Open.	A grand specimen.
„ <i>nobilis</i>	30	50	4 7	—	Sheldt.	Vigor.; growing in clump.
„ <i>Nordmanniana</i> ...	30	45	4 0	—	„	„
<i>Cedrus atlantica</i>	45	48	6 6	—	„	Fine; growing among others.
<i>Pinus Pallasiana</i>	70	50	7 7	—	„	Fine clean bole of 15 ft.
<i>Wellingtonia gigantea</i>	30	48	6 6	—	„	The finest of several growing in clumps.

GENERAL REMARKS.—The newer Conifers are generally doing well and growing fast in the light warm soil, and many of them promise to make useful and handsome trees.

DARNAWAY. EARL OF MORAY.

Altitude, 100 feet. Soil, light loam; subsoil, gravelly clay.

Correspondent: Mr. D. SCOTT, Forester, Darnaway Castle, Forres.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	18	43	4 0	24	Sheldt.	Very vigorous.
„ <i>lasiocarpa</i>	28	45	4 1	22	„	„
„ <i>Menziesii</i>	18	45	3 0	30	„	Fine; fast-growing.
„ <i>nobilis</i>	15	35	3 8	19	„	Very vigorous.
<i>Pinus monticola</i>	28	50	4 4	18	N.	A fine fast-growing tree.
<i>Wellingtonia gigantea</i> ...	18	28	4 2	12	Sheldt.	Fine specimen.

GENERAL REMARKS.—Most kinds of hardy Conifers do well and grow vigorously here, when due attention is paid to planting them in well-drained ground. They chiefly delight in a free open soil, and a porous subsoil; the Spruces and some others preferring a cool subsoil, but not a wet, sour, or impervious one. *Abies nobilis*, *A. Douglasii*, and some others of the fast-growing Conifers, are liable to lose their leaders from high winds, and should be planted where they can be sheltered from the prevailing storms. The *Wellingtonia* thrives remarkably well, and many fine specimens grow in this district.

GORDON CASTLE. DUKE OF RICHMOND AND GORDON.

Altitude, 70 to 200 feet. Soil, deep loam; subsoil, gravelly clay.

Correspondent: Mr. CHARLES WEBSTER, The Gardens, Gordon Castle, Fochabers.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	32	50	4 8	20	Sheldt.	Vigorous.
„ <i>lasiocarpa</i>	24	48	6 4	19	S.W.	Very fine specimen.
„ <i>Nordmanniana</i> ..	30	45	4 2	20	Sheldt.	Handsome tree.
„ <i>Smithiana</i>	35	40	4 8	16	„	Fine graceful habit.
<i>Araucaria imbricata</i>	41	40	5 0	16	„	Fine healthy specimen.
<i>Cedrus atlantica</i>	18	18	3 6	17	„	Doing well.
„ <i>Deodara</i>	40	42	6 9	35	„	Very graceful.
<i>Pinus Laricio</i>	40	48	5 5	28	S.	Strong growing.
<i>Thuja gigantea</i>	30	48	4 9	30	„	Vigorous.
<i>Wellingtonia gigantea</i> ...	30	52	7 9	16	„	Very handsome tree.

GENERAL REMARKS.—All the Conifers mentioned are thriving well; and so are a great number of smaller plants of many other species. Two fine specimens that grew here of *Abies nobilis*, which were said to have been raised from seed sent to the Duke of Gordon over 70 years ago, were blown down during a severe gale about 30 years ago, after having reached a height of 65 to 70 feet.

NAIRNSHIRE.

CAWDOR CASTLE. EARL OF CAWDOR.

Altitude, 300 feet. Soil, sandy loam; subsoil, gravel

Correspondent: Mr. CHARLES CLARK, Forester, Cawdor, Nairn.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	25	56	3 2	23	E.	Very healthy.
„ <i>Douglasii</i>	20	40	4 4	32	„	„ „
„ <i>nobilis</i>	20	40	3 4	18	„	„ „
„ <i>Nordmanniana</i> ...	20	20	1 6	14	„	„ „
„ <i>pectinata</i>	—	60	8 6	37	W.	Fine tree.
„ <i>Webbiana</i>	35	35	4 4	20	„	Fine specimen.
<i>Araucaria imbricata</i>	35	35	4 2	24	E.	„ „
<i>Cupressus Lawsoniana</i> ...	25	35	4 2	30	„	Vigorous and free.
<i>Wellingtonia gigantea</i> ...	35.	40	6 10	24	W.	Fine specimen.

REMARKS.—The above are healthy and vigorous trees, and have all the appearance of forming large and useful timber trees at some future time. To show how well the old trees have grown here, there is an Ash 50 feet in height, 20 feet 8 inches in girth, and 84 feet diameter of branches; a Beech 60 feet high, 13 feet girth, and 114 feet diameter of branches; and another of the same height, 16 feet 6 inches girth, and 102 feet in spread of branches; very ornamental trees. A fine Walnut on the Castle lawn is 60 feet high, 15 feet 6 inches in girth, and 69 feet in diameter of branches. All girths are at 5 feet from the ground.

ORKNEY.

ISLE OF SHAPINSHAY. Colonel BALFOUR.

Altitude, 30 to 50 feet. Soil, light and heavy loam; subsoil, gravel and clay.

Correspondent: Mr. THOMAS MACDONALD, The Gardens, Balfour Castle, Kirkwall.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure.	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Araucaria imbricata</i> ...	24	18	2 0	14	N.	Healthy and vigorous.
<i>Cedrus Deodara</i>	18	7	—	10	S.	„ moderate growth.
<i>Cupressus macrocarpa</i> ...	18	16	—	25	E.	Very healthy and vigorous.
<i>Pinus austriaca</i>	18	12	1 0	—	„	Scarcely worth growing.
<i>Thuya gigantea</i>	18	18	1 2	6	S.	Moderately vigorous.

GENERAL REMARKS.—The *Araucaria imbricata* and *Cupressus macrocarpa* are the most valuable Conifers we have tried in this island, both standing the stormy winds and saline breezes without any signs of injury. The above *Araucaria* is a well-furnished tree, and girths at the ground 3 ft. 2 in. The Cypress girths

3 feet at the ground, and is a handsome, spreading, well-furnished specimen, in vigorous health. Of the older Coniferae, the Larch, twenty years of age, is 20 ft. high, and girths 1 ft. 10 in. at 5 feet up, with a spread of branches 14 ft. in diameter, growing in heavy loam, resting on clay; about 30 feet above sea level, and sheltered by hardwood trees. Norway Spruce of the same age girths 1 ft. 6 in. at 5 feet up, and the branches 18 ft. diameter at the ground; growing in heavy loam, resting on cold clay, in which the trees are not thriving. Silver Fir, 26 years of age, is 18 ft. high, girths 1 ft. 8 in. at 5 feet up, with branches 18 ft. in diameter, growing in a rich black soil, at an altitude of about 40 feet, and sheltered with hardwood; but the top is not thriving. These are all the Conifers worth note growing at Balfour Castle or on the island of Shapinsay; but a number of hardwoods thrive very well, and such evergreens as Escallonias, Veronicas, Myrtle, Hollies, Euonymus, Cotoneasters, Mahonias, and Fuchsias grow with considerable luxuriance, and greatly aid in giving a fresh and well-clothed appearance to the grounds.

PERTHSHIRE.

ABERCAIRNY. CHARLES S. H. D. MORAY, Esq.

Altitude, 150 feet. Soil, stiff loam; subsoil, clay and rock.

Correspondent: Mr. JAMES BROWN, The Gardens, Abercairny, Crieff.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	All planted from 25 to 30 years ago.	55	4 4	34	S.	Fine specimen.
„ <i>cephalonica</i>		50	5 0	25	„	Moderate grower.
„ <i>concolor</i>		30	3 0	16	„	„
„ <i>Douglasii</i>		65	7 0	40	„	Vigorous; fine tree.
„ <i>grandis</i>		58	4 6	20	„	„
„ <i>magnifica</i>		18	1 6	12	„	Apt to lose its leader.
„ <i>Menziesii</i>		76	7 5	41	„	Vigorous; free growing.
„ <i>nobilis</i>		40	3 6	23	„	„
„ <i>Nordmanniana</i> ..		26	2 6	15	„	Makes a pretty tree.
„ <i>orientalis</i>		34	4 6	15	„	„
<i>Araucaria imbricata</i>		40	4 0	23	„	Fine specimen.
<i>Cedrus Deodara</i>		44	4 6	25	„	„
<i>Cupressus Lawsoniana</i> ..		38	5 0	12	„	Vigorous; fine tree.
<i>Pinus austriaca</i>		35	3 6	30	„	Spreading; coarse.
„ <i>Cembra</i>		55	7 0	33	„	„
„ <i>excelsa</i>		42	5 0	24	„	„ pretty.
„ <i>Laricio</i>		33	4 0	20	„	Straggling tree.
„ <i>monticola</i>		35	2 6	15	„	Fine specimen.
„ <i>ponderosa</i>		27	3 0	16	„	„
<i>Taxodium sempervirens</i> ..		47	7 0	30	„	„
<i>Thuya gigantea</i>		40	2 6	20	„	„
<i>Thuyopsis borealis</i>		34	3 6	16	„	Very elegant specimen.
„ <i>dolabrata</i> ..		10	—	8	„	„
<i>Wellingtonia gigantea</i> ..		50	5 0	2	„	Vigorous; fine tree.

GENERAL REMARKS.—Most of the Firs and Spruces do well, and form fine specimens on the stiff soil. *Abies Menziesii*, *A. Albertiana*, *A. grandis*, *A. Douglasii*, and *A. nobilis* grow with the greatest vigour, and make annual growths of two to three feet, or more, in length.

CASTLE MENZIES. SIR ROBERT MENZIES, Bart.

Altitude, 300 to 350 feet. Soil, loam ; subsoil, gravel and rocky.

Correspondent : Mr. J. EWING, The Gardens, Castle Menzies, Aberfeldy.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. in.	Feet		
<i>Abies Albertiana</i>	38	72	5 9	38	S.	Ripens seed freely.
„ <i>Douglasii</i>	46	92	7 1	35	„	Grows vigorously.
„ <i>grandis</i>	24	68	5 1	38	„	Growing rapidly.
„ <i>Lowii</i>	34	52	3 5	15	„	Handsome tree.
„ <i>Menziesii</i>	46	96 $\frac{1}{2}$	11 0	56	„	Very healthy ; fine tree.
„ <i>nobilis</i>	24	50	3 6	21	„	„ „
„ <i>Nordmanniana</i> ...	33	49	3 9	27	„	„ „
<i>Araucaria imbricata</i>	47	31	3 1	15	„	„ „
<i>Cedrus Deodara</i>	36	38	4 10	31	„	„ „
<i>Cupressus Lawsoniana</i> ...	36	36	5 3	19	„	„ „
<i>Pinus Cembra</i>	47	50	3 8	14	„	In a confined place.
„ <i>Jeffreyi</i>	36	39	3 11	23	„	Healthy.
„ <i>monticola</i>	15	32	1 7	9	„	Growing very fast.
<i>Taxodium sempervirens</i>	43	74	4 6	21	„	Growing in old quarry.
<i>Thuja gigantea</i>	34	36	4 3	13	„	Very healthy ; fine.
<i>Wellingtonia gigantea</i> ...	35	52	13 9	27	„	„ very fine tree.

GENERAL REMARKS.—The Conifers growing in the grounds at Castle Menzies are well sheltered from the north by a steep hill, and most of them grow rapidly, and with great vigour. *Abies Menziesii*, of which the *exact* height and girth at the present date, October 1, 1891, are given, has grown and is still growing fast, and has produced, in a given time, the largest amount of timber of any Conifer here. The *Wellingtonia*, *Taxodium*, *Cryptomeria*, and the like, grow very freely. Several kinds freely ripen seed, from which many young plants have been raised and are thriving well.

CULTOQUHEY. JAMES MAXTONE GRAHAM, Esq.

Altitude, 297 feet. Soil, light loam; subsoil, red sandstone.

Correspondent: JAMES MAXTONE GRAHAM, Esq., of Cultoquhey, Crief.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	18	57	4 0	34	S.	Vigorous & fast growing.
„ <i>concolor</i>	31	44	3 0	14	„	Handsome.
„ <i>Douglasii</i>	47	63	7 6	51	„	Spreading tree; very fine.
„ <i>grandis</i>	31	57	4 6	28	„	Vigorous; fine tree.
„ <i>Menziesii</i>	40	64	6 3	36	„	„ „
„ <i>nobilis</i>	31	51	3 8	19	„	„ „
„ <i>Nordmanniana</i> ...	36	68	6 6	25	„	Handsome specimen.
<i>Araucaria imbricata</i> ...	41	44	5 0	25	„	„ „
<i>Cedrus atlantica</i>	—	59	6 0	28	„	„ „
„ <i>Deodara</i>	41	32	5 6	27	„	„ „
<i>Cupressus Lawsoniana</i>	30	30	4 6	20	„	„ „
<i>Pinus Cembra</i>	64	48	6 8	20	„	„ „
<i>Taxodium sempervirens</i>	31	45	6 6	21	„	Thriving well.
<i>Thuyopsis borealis</i>	30	30	—	23	„	Very graceful.
<i>Wellingtonia gigantea</i>	33	50	9 0	23	„	Very fine specimen.

DUNKELD. DUKE OF ATHOLE.

Altitude, 100 to 200 feet. Soil, light loam; subsoil, gravelly.

Correspondent: Mr. P. W. FAIRGRIEVE, The Gardens, Dunkeld.

Botanical Name	Age	Height	Girth at 5 ft. up	Exposure	Remarks
	Years	Feet	Ft. In.		
<i>Abies Albertiana</i>	19	29	2 4½	S.E.	Vigorous.
„ <i>Douglasii</i>	45	94	12 0	„	Vigorous; very fine tree.
„ <i>magnifica</i>	16	20	1 9	S.	Moderate growth.
„ <i>nobilis</i>	22	50	2 7	W.	Vigorous.
„ <i>Nordmanniana</i> ...	—	26	1 11	N.	Very strong growing.
„ <i>orientalis</i>	—	45	2 0½	N.E.	Vigorous; handsome.
<i>Araucaria imbricata</i> ...	40	50	3 2	S.	Sheltered; very fine tree.
<i>Cedrus atlantica</i>	26	25	3 4	„	Planted by the Queen; vigorous; lost top.
„ <i>Deodara</i>	38	50	5 8½	„	Vigorous; fine tree.
<i>Cupressus Lawsoniana</i>	26	45	1 7½	„	Sheltered; very vigorous.
<i>Pinus Cembra</i>	14	16	1 0	N.	Moderate growth.
<i>Thuyopsis dolabrata</i> ...	16	18	1 4	E.	Vigorous.
<i>Wellingtonia gigantea</i>	24	41	5 10	S.	Very healthy; fine specim.

GENERAL REMARKS.—All kinds of hardy Conifers grow vigorously in the district, and many fine specimens stand in the grounds here. The above *Abn Douglasii* is a very fine tree, and girths, at 1 foot from the base, 14 ft. 6 in.; at 3 feet, 12 ft. 6 in.; at 8 feet, 9 ft. 10 in.; at 40 feet, 5 ft. 9 in.; and at 75 feet, 1 ft. 6 in.; the exact total height being 94 feet.

DUPLIN CASTLE. EARL OF KINNOULL.

Altitude, 70 to 230 feet. Soil, loam; subsoil, clay, and rocky.

Correspondent: Mr. JOHN BROWNING, The Gardens, Dupplin Castle, Perth.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	32	60	5 3	40	S.	Sheltered; fine tree.
" <i>concolor</i>	28	29	3 10	21	S.W.	Nice specimen.
" <i>Douglasii</i>	32	75	7 1	42	E.	Open to E.; very fine tree.
" <i>grandis</i>	30	65	5 8	32	S.	Sheltered; vigorous.
" <i>Menziesii</i>	28	50	4 5	35	S.E.	"
" <i>nobilis</i>	32	66	5 8	27	S.	Exposed all round; fine.
" <i>Nordmanniana</i> ...	29	48	4 0	23	"	Sheltered; pretty tree.
<i>Araucaria imbricata</i> ...	32	54	5 6	27	"	" very fine specimen.
<i>Cedrus atlantica</i>	30	28	3 10	22	"	Slow growing.
" <i>Deodara</i>	32	49	5 4	38	"	Sheltered; fine specimen.
<i>Cupressus Lawsoniana</i>	32	55	4 3	14	"	" "
<i>Pinus austriaca</i>	28	24	2 9	14	"	Exposed.
" <i>Cembra</i>	28	24	1 9	12	"	"
" <i>Laricio</i>	28	30	3 9	21	N.E.	"
" <i>monticola</i>	28	28	3 5	20	S.	"
" <i>ponderosa</i>	28	29	3 5	21	"	"
<i>Taxodium sempervirens</i>	32	60	7 9	38	"	Sheltered; fine specimen.
<i>Thuja gigantea</i>	30	50	4 8	20	"	" "
<i>Thuyopsis borealis</i>	28	25	1 9	13	"	" "
<i>Wellingtonia gigantea</i>	28	55	8 6	24	"	Exposed; very fine tree.

GENERAL REMARKS.—The newer Conifers have been planted in considerable numbers on this estate, and on the whole they are growing very satisfactorily. *Abies Albertiana*, *A. Douglasii*, *A. grandis*, and *A. nobilis* grow most vigorously, but scarcely any of the hardier species fail to make a good average growth.

KEIR. SIR JOHN M. STIRLING MAXWELL, Bart.

Altitude, 200 to 300 feet. Soil, heavy loam ; subsoil, red sandstone.

Correspondent : Mr. THOMAS LUNT, The Gardens, Keir House, Dunblane.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	24	30	1 4	17	S.	Healthy.
" <i>coarcolor</i>	25	37	3 6	15	"	Handsome specimen.
" <i>Douglasii</i>	42	45	11 6	55	"	Fine sprdg. tree; lost top.
" <i>grandis</i>	28	55	4 2	25	S.E.	Vigorous ; fast growing.
" <i>Menziesii</i>	40	61	7 3	45	S.	" " " "
" <i>nobilis</i>	40	82	5 8	28	"	Very fine specimen.
" <i>Nordmanniana</i> ...	40	47	5 0	25	"	Vigorous.
" <i>Picea</i>	36	37	4 9	24	"	Fine specimen ; top lost.
" <i>Smithiana</i>	40	46	6 0	28	"	Graceful habit.
" <i>Webbiana</i>	40	30	5 4	34	"	Nice tree ; top lost.
<i>Araucaria imbricata</i>	45	44	5 0	—	"	Fine tree ; 1st. lwr. brchs.
<i>Cedrus Atlantica</i>	40	45	5 0	20	"	Nice thriving trees.
" <i>Deodara</i>	40	48	4 8	20	"	" " " "
<i>Cryptomeria japonica</i> ...	40	42	9 8	27	"	Fine specimen.
<i>Cupressus Lawsoniana</i> ...	28	34	3 9	12	S.E.	Vigorous & free growth.
" <i>macrocarpa</i> ...	38	47	4 0	—	S.	Clipped into long cone-
" <i>sempervirens</i> ..	45	40	1 9	—	"	shaped trees.
" <i>thyoides</i>	35	28	4 2	13	"	Nice specimen.
<i>Juniperus recurva</i>	35	30	—	22	"	Very fine bushy specimen.
<i>Pinus austriaca</i>	40	48	6 2	37	"	Branchy ; rough.
" <i>Cembra</i>	35	38	4 0	20	"	Fine specimen.
" <i>excelsa</i>	40	49	5 2	29	"	" " "
" <i>insignis</i>	40	54	9 4	42	"	" " "
" <i>Lambertiana</i>	40	46	6 0	35	"	" " "
" <i>Laricio</i>	36	51	5 10	27	"	Vigorous ; rough.
" <i>monticola</i>	40	54	5 3	30	"	Fine tree.
" <i>Pallasiana</i>	40	33	5 0	30	"	Branchy ; rough.
" <i>pyrenaica</i>	40	35	5 4	32	"	" " "
<i>Thuya gigantea</i>	28	47	5 4	16	S.E.	Handsome specimen.
<i>Thuyopsis borealis</i>	28	30	2 6	11	"	" " "
<i>Wellingtonia gigantea</i> ...	28	52	8 6	19	"	Very fine specimens.

GENERAL REMARKS.—The fine collection of Conifers formed here about forty years ago by the late Sir William Stirling Maxwell, Bart., is now a leading feature in the pleasure grounds and gardens. Many of the species have attained to large dimensions, as the table shows, and, except where they have been allowed to become crowded, most of them are very handsome specimens. All the newer hardy Conifers have been added to the collection as they appeared, and are mostly doing well, especially those of Japanese origin.

METHVEN CASTLE. WILLIAM SMYTHE, Esq.

Altitude, 260 to 280 feet. Soil, loam; subsoil, till, and rocky.

Correspondent: Mr. PETER WHITTON, The Gardens, Methven, Perth.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	23	68	4 7	27	E.	Beautiful specimen.
„ <i>Douglasii</i>	33	65	6 10	33	open.	A grand tree.
„ <i>grandis</i>	21	35	4 0	12	„	„
„ <i>Hookeriana</i>	34	15	1 1	8	sheltd.	Slow growing; pretty.
„ <i>magnifica</i>	13	25	2 2	9	open.	Handsome; promising.
„ <i>Morinda</i>	50	50	6 11	25	sheltd.	Beautiful tree.
„ <i>nobilis</i>	21	35	2 7	12	open.	Thrives well here.
„ <i>Nordmanniana</i> ...	22	35	2 5	15	sheltd.	Fine specimen.
„ <i>Pattoniana</i>	34	25	2 2	10	„	Small tree; pretty.
<i>Araucaria imbricata</i> ...	35	35	4 3	16	open.	Fine; leaves sometimes injured.
<i>Cedrus atlantica</i>	35	20	3 0	10	sheltd.	Slow growing.
„ <i>Deodara</i>	25	30	2 8	10	open.	Many fine trees.
„ <i>Libani</i>	—	90	9 10	25	sheltd.	Fine tree.
<i>Cryptomeria japonica</i> ...	35	30	5 5	12	„	Fine; best in shelter.
<i>Cupressus Lawsoniana</i>	33	45	5 4	15	open.	Grand specimen.
<i>Libocedrus decurrens</i> ...	30	25	3 5	8	sheltd.	Beautiful tree.
<i>Pinus Cembra</i>	50	35	3 9	10	open.	Very slow growing.
„ <i>Lambertiana</i>	50	30	2 7	9	„	Fine; requires shelter.
<i>Thuyopsis borealis</i>	33	37	3 4	12	sheltd.	Grand specimen.
<i>Wellingtonia gigantea</i>	25	61	7 5	16	„	Very handsome tree.

GENERAL REMARKS.—The above are the measurements and particulars of some of the finest specimens of the Conifers growing here, and as a rule they are all thriving well. I have planted all of them that are under forty years of age; and have raised them from seeds, cuttings, or two-year-old seedling plants, nothing older being got. In many cases the plants from cuttings are thriving as vigorously as my seedlings and forming as fine specimens; but, when they can be had, seedlings are to be preferred.

MURTHLY CASTLE. W. STEUART FOTHERINGHAM, Esq.

Altitude, 100 to 300 feet; soil, light and heavy loam, and peaty;
subsoil, gravel and clay.

Correspondent: Mr. JAMES LAURIE, The Gardens, Murthly Castle, Perth.

Botanical Name	Age	Height	Girth at 5 ft. up.	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	32	56	5 8	32	E.	Fast growing; beautiful tree.
" <i>canadensis</i>	50	30	2 7	22	W.	Healthy; slow growing.
" <i>cephalonica</i>	45	36	5 10	26	N.	Best on north aspect.
" <i>concolor</i>	27	35	3 2	16	S.E.	Very handsome; hardy.
" <i>Douglasii</i>	45	76	11 9	49	"	Very vigorous; gr'ws 3 ft. y'ly.
" <i>grandis</i>	40	63	4 8	22	"	Fast grower; very vigorous.
" <i>Hookeriana</i>	30	30	4 0	15	S.	Fine ornamental tree.
" <i>magnifica</i>	25	35	2 3	9	"	Very ornamental and hardy.
" <i>Menziesii</i>	47	86	9 6	45	"	Will supplant the Spruce.
" <i>nobilis</i>	45	75	6 4	24	"	Fast growing; very fine tree.
" <i>Nordmanniana</i> ...	38	50	3 11	18	"	Very fine, well-clothed tree.
" <i>orientalis</i>	40	30	2 7	12	"	As free as the Spruce; fine.
" <i>Pattoniana</i>	30	35	3 10	14	"	Fine ornamental tree.
" <i>Pinsapo</i>	45	46	5 5	28	"	" "
" <i>Smithiana</i>	35	33	3 7	18	"	" "
<i>Araucaria imbricata</i> ...	45	45	4 8	18	"	" many bearing cones.
<i>Cedrus atlantica</i>	40	45	5 7	28	"	Very fine; grows freely.
" <i>Deodara</i>	50	52	6 4	26	"	" bearing cones first time.
" <i>Libani</i>	50	46	5 2	23	"	Growing freely; fine trees.
<i>Cryptomeria japonica</i> ...	40	40	4 2	26	N.	Fine ornamental tree.
<i>Cupressus Lawsoniana</i>	33	50	3 8	11	S.	Very fine; timber excellent.
" <i>thyoides</i>	40	45	2 9	12	"	Fine ornamental tree.
<i>Fitzroya patagonica</i> ...	30	16	1 1	8	"	" "
<i>Juniperus sinensis</i>	35	27	1 4	9	"	" "
<i>Pinus austriaca</i>	25	30	5 7	24	"	Timber of no value.
" <i>Cembra</i>	45	30	4 7	17	"	Goes back unless top-dressed
" <i>monticola</i>	40	67	5 6	18	"	Fine rapid growing tree.
" <i>Strobis</i>	55	50	7 8	42	"	Ornamental.
<i>Taxodium sempervirens</i>	35	45	8 10	12	"	Fine in damp places.
<i>Thuja gigantea</i>	30	56	3 8	15	"	A beautiful tree.
<i>Thuyopsis borealis</i>	30	50	1 9	9	"	" "
<i>Wellingtonia gigantea</i> (1)	35	66 ¹ / ₂	9 3	26	"	Finest of three oldest trees.
" " (2)	30	61	6 6	20	"	Raised from a cutting.

GENERAL REMARKS.—Hardy Conifers grow here with great vigour and luxuriance, especially such free growers as *Abies Douglasii*, *A. grandis*, *A. Menziesii* and *A. nobilis*, many of which make leaders of three feet and upwards annually; and being planted in large numbers they partly shelter each other, and do not get their heads broken off so readily as when they are towering singly high above other trees. All the *Abies* tribe seem to thrive peculiarly well in the soil and climate of this district. The same may be said of *Cupressus Lawsoniana*, *C. thyoides*, *Thuja gigantea*, *Thuyopsis borealis*, and *Wellingtonia gigantea*, all of which are thriving and growing vigorously. The *Araucaria imbricata* and *Cedrus Deodara* are also thriving well as single specimens, and form picturesque groups and avenues. The *Deodara* has borne cones this season for the first time on trees about 50 years old. The *Araucaria* cones freely here, and there is a heavy crop of cones on many of them this year. *Pinus monticola* is a very hardy

and free-growing Pine, and proves to be one of the best of those introduced from North-west America. *Abies Albertiana*, *Thuja gigantea* and *Cupressus Lawsoniana*, from the same regions, are also free-growing and very promising trees. Among the finest ornamental trees and shrubs may be mentioned *Abies concolor*, *A. Hookeriana*, *A. magnifica*, *A. Nordmanniana*, *A. orientalis*, *A. Pattoniana*, *A. Pinsapo*, *A. Smithiana*, *Biota orientalis*, *Cryptomeria japonica*, *Cupressus Lawsoniana*, *C. Lambertiana*, *C. thyoides*, *Juniperus chinensis*, *J. excelsa*, *J. recurra*, *Libocedrus decurrens*, *Retinospora obtusa*, *R. pisifera*, *R. plumosa*, *Taxus baccata aurea*, *Thuyopsis borealis*, *T. dolabrata*, and *Wellingtonia gigantea*. Many other species and numerous varieties of the newer Conifers are growing very satisfactorily.

OCHTERTYRE. SIR PATRICK KEITH MURRAY, Bart.

Altitude, 300 to 450 feet. Soil, light loam; subsoil, trap rock.

Correspondent: Mr. GEORGE CROUCHER, The Gardens, Ochertyre, Crief.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	19	54	3 6	22	Open	Graceful & quick grwing.
„ <i>ajanensis</i>	16	24	1 8	20	S.	Perhaps the finest of Japanese Conifers.
„ <i>concolor</i>	7	7	—	—	„	Very promising.
„ <i>Douglasii</i>	36	70	6 10	55	„	Fast grower; much brkn. by snow and wind.
„ „ <i>Stairii</i> ...	17	20	1 4	13	„	Very attractive.
„ <i>grandis</i>	17	46	4 0	29	„	One of the finest Conifers
„ <i>Hookeriana</i>	17	19	1 1	14	„	Very ornamental.
„ <i>magnifica</i>	16	24	1 6	10	„	Handsome tree.
„ <i>Menziesii</i>	36	77	7 4	46	„	Vig. grower; fine tree.
„ <i>Morinda</i>	58	44	6 6	30	„	Very fine specimen.
„ <i>nobilis</i>	30	61	5 6	23	„	Rapid grower; handsome.
„ <i>Nordmanniana</i> ..	22	29	3 0	15	„	From seed sown in 1866.
„ <i>Pattoniana</i>	17	17	1 2	13	„	Beautiful lawn Conifer.
„ <i>Veitchii</i>	17	24	1 6	7	„	„ free-growing tree.
<i>Araucaria imbricata</i> ..	20	21	2 0	18	Open	From seed sown in 1865.
<i>Cedrus atlantica</i>	33	34	4 0	24	S.	Lost leader few years ago.
„ <i>Deodara</i>	31	45	4 0	30	„	Seed from India, 1854.
<i>Cupressus Lawsoniana</i> ...	27	30	4 0	15	„	Thrives everywhere.
<i>Pinus austriaca</i>	17	19	1 9	13	„	Dies off at 30 to 40 years.
„ <i>Bolanderii</i>	7	19	1 1	9	Open	The qkst-grwg Pine here.
„ <i>Cembra</i>	36	44	4 0	16	S.	Good ornamental Pine.
„ <i>excelsa</i>	7	16	0 10	9	Open	Grows fast; graceful.
„ <i>Jeffreyi</i>	16	17	1 2	8	„	Moderate grower.
„ <i>koraiensis</i>	16	13	1 3	8	„	Makes a pretty specimen.
„ <i>Laricio</i>	16	24	2 0	12	„	Not ornamental.
„ <i>monticola</i>	16	30	1 9	13	„	Handsm. free-grwg. tree.
„ <i>ponderosa</i>	30	33	3 5	18	„	From seed sown in 1859; fine robust Pine.
<i>Saxe-Gothæa conspicua</i>	19	10	—	6	S.	Very interesting.
<i>Taxodium sempervirens</i>	20	38	5 1	26	„	Ornamental.
<i>Thuja gigantea</i>	20	43	3 0	17	„	Beautiful & fast growing.
<i>Thuyopsis borealis</i>	27	32	2 0	13	„	From a cutting in 1861; beautiful specimen.
<i>Wellingtonia gigantea</i> ...	28	42	7 0	27	„	Fine specimen; from a cutting in 1858.

GENERAL REMARKS.—The ages of the trees are calculated from the year they were planted. All the specimens of which the details are given are thriving well; the soil and the locality being well adapted for the growth of coniferous plants, of which there are in all some 180 species and varieties growing in the grounds and policies at Ochertyre. Some of them I have raised from seed, others have been struck from cuttings; and the remainder bought, as small plants, chiefly from Messrs. Veitch & Sons, Chelsea; and Messrs. Dickson & Turnbull, Perth. Among the fastest-growing and finest trees are:—*Abies Albertiana*, *A. Douglasii*, *A. grandis*, *A. Menziesii*, *A. nobilis*; *Pinus Bolanderii*, *P. monticola*, and *Thuja gigantea*. Of more moderate growth, but very handsome and ornamental, are *Abies ajanensis*, *A. concolor*, *A. D. Stairii*, *A. Hookeriana*, *A. Lowii*, *A. magnifica*, *A. Morinda*, *A. Pattoniana*, *A. Veitchii*, *Cupressus Lawsoniana*, *Libocedrus decurrens*; *Pinus excelsa*, *P. koraiensis*, *Thuyopsis borealis*, and *Wellingtonia gigantea*. Most of the Conifers here are growing in a light sandy loam, resting on open trap rock, on a steep hillside, with a southern aspect. Conifers of a tender nature are rather uncertain, and generally succumb the first severe winter. Most of the hardier Japanese species thrive remarkably well, and form beautiful specimens of the greatest attraction in the pleasure grounds.

ROSSIE PRIORY. LORD KINNAIRD.

Altitude, 80 feet. Soil, light and stiff loam; subsoil, gravelly.

Correspondent: Mr. JOHN R. MCKIDDIE, The Gardens, Rossie Priory, Inchtute.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	—	55	3 10	25	S.	Vigorous.
„ <i>Douglasii</i>	—	85	10 0	56	W.	„
„ „ <i>stricta</i>	—	80	8 0	38	S.	Very healthy.
„ <i>grandis</i>	—	50	5 0	24	„	Strong grower.
„ <i>magnifica</i>	23	36	4 0	16	S.E.	„
„ <i>Menziesii</i>	—	70	9 0	45	N.	„
„ <i>nobilis</i>	25	56	4 3	18	E.	Very vigorous.
„ <i>Nordmanniana</i> ...	—	42	4 0	21	S.	„
<i>Araucaria imbricata</i> ...	—	50	5 0	20	W.	Well sheltered; sickly.
<i>Cedrus atlantica</i>	—	42	7 9	21	S.E.	Healthy.
„ <i>Deodara</i>	—	70	5 9	23	„	Very healthy.
<i>Cupressus Lawsoniana</i>	—	55	4 0	16	„	„
<i>Juniperus sinensis</i>	—	19	2 0	6	S.	„
<i>Pinus austriaca</i>	—	35	3 4	15	S.E.	Healthy; poor specimen.
„ <i>Cembra</i>	—	25	3 0	12	„	„ fine „
„ <i>excelsa</i>	—	40	5 4	20	„	„ poor „
„ <i>Jeffreyi</i>	—	24	3 0	18	S.	„ good „
„ <i>Laricio</i>	—	45	6 6	24	„	Unhealthy.
„ <i>ponderosa</i>	—	35	3 6	14	„	Healthy; poor specimen.
„ <i>Strobis</i>	—	45	6 6	33	„	„ good „
<i>Taxodium sempervirens</i>	—	50	11 6	28	„	Healthy and thriving.
<i>Thuja Craigiana</i>	—	42	3 6	19	„	„ „
„ <i>Menziesii</i>	—	40	3 10	21	„	„ „
<i>Wellingtonia gigantea</i> ..	30	50	8 0	20	„	Healthy and vigorous.

GENERAL REMARKS.—With few exceptions, the Conifers here are growing in a sandy loam and gravelly subsoil, and are well sheltered from the north. Cedars grow freely, and most of the Firs, Spruces, Cypresses, and Thuyas are doing well.

SCONE. EARL OF MANSFIELD.

Altitude, 50 feet. Soil, loam; subsoil, clay.

Correspondent: Mr. ALEXANDER MACKINNON, The Palace Gardens, Scone, Perth.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	52 $\frac{1}{2}$	5 4	33	Sheldt.	In perfect health.
„ <i>cephalonica</i>	31	41	3 6	20	N.E.	Thriving specimen.
„ <i>concolor</i>	31	41 $\frac{1}{2}$	4 0	16	N.	Fine vigorous tree.
„ <i>Douglasii</i>	64	83	9 1	42	WNW	Fine tree; 124 cub. ft. timber.
„ <i>grandis</i>	31	48 $\frac{1}{2}$	4 10	29	N.	Vig. health; grows fast.
„ <i>Hookeriana</i>	20	19	—	12	„	Beautiful healthy tree.
„ <i>Menziesii</i>	39	71	8 5	56	„	Vigorous; fine specimen.
„ <i>nobilis</i>	39	72	6 11	43	„	Fine tree; in perfect health.
„ <i>Nordmanniana</i> ...	31	46 $\frac{1}{2}$	4 3 $\frac{1}{2}$	22	Sheldt.	Rather going back.
„ <i>Pinsapo</i>	39	47	—	25	N.	Healthy; fine specimen.
<i>Araucaria imbricata</i> ...	39	40	4 6	25	„	Fine specimen, with cones.
<i>Cedrus atlantica</i>	39	52	4 5	31	„	In good condition.
„ <i>Deodara</i>	37	44	4 4 $\frac{1}{2}$	28	S.E.	Not thriving, as a rule.
<i>Cupressus Lawsoniana</i>	31	29	3 10	18	Sheldt.	In perfect health.
<i>Pinus austriaca</i>	31	43	4 0	24	N.	In good condition.
„ <i>Cembra</i>	39	45	4 6	24	„	Going back.
„ <i>Jeffreyi</i>	31	32	3 6	17	N.E.	Doing fairly well.
„ <i>monticola</i>	39	71 $\frac{1}{2}$	5 11	30	N.	Fine healthy tree.
„ <i>ponderosa</i>	31	50	6 8 $\frac{1}{2}$	32	„	Doing fairly well.
<i>Taxodium sempervirens</i>	28	42	3 3	17	Sheldt.	In fine health; grows well.
<i>Thuja gigantea</i>	31	28	3 8	16	N.	Thriving well.
<i>Thuyopsis borealis</i>	31	31	—	15	„	Fine graceful tree.
<i>Wellingtonia gigantea</i>	31	60 $\frac{1}{2}$	7 4	19	N.E.	Vigorous; fine specimen.

GENERAL REMARKS.—These Conifers are all growing in the Pinetum in the grounds at Scone Palace, and a record has been kept of them from the beginning. The soil is a rather heavy, cool loam, resting on clay, on which most of the Firs and Spruces thrive admirably, except the somewhat tender species, such as *Abies bracteata*, *A. Pindrow*, and *A. Webbiana*. Among the more recently planted species and varieties, *Abies ajanensis*, *A. Aleoekiana*, *A. concolor violacea*, *A. Engelmannii*, *A. E. glauca*, and *A. Pattoniana* are all thriving well, and promising to make handsome specimens. The *Araucaria*, *Wellingtonia*, *Taxodium sempervirens*, *Cupressus Lawsoniana*, *Thuja gigantea*, and *Thuyopsis borealis* are all vigorous and beautiful trees. Of the Pines, *Pinus monticola* thrives best; several others doing moderately well.

SCONE ESTATES. EARL OF MANSFIELD.

Correspondent: Mr. LEWIS BAYNE, Forester, Jeanie Bank, Perth.

1. GROWING IN SCONE PLANTATIONS.

Altitude, 200 to 300 feet. Soil, moorish; subsoil, tilly.

Botanical Name	Age	Height	Girth at 5 ft. up	Remarks
	Years	Feet	Ft. In.	
<i>Abies Douglasii</i> (1).....	34	67 $\frac{1}{2}$	4 8 $\frac{1}{4}$	The Douglas Fir plantation on the Scone estate extends to 13 acres, and was planted in the spring of 1857. It is very healthy and thriving well, as the measurements show.
" " (2).....	34	58	4 7	
" " (3).....	34	62 $\frac{1}{2}$	3 11	
" " (4).....	34	70 $\frac{1}{2}$	4 3 $\frac{1}{2}$	
" " (5).....	34	59	5 1 $\frac{1}{2}$	
" " (6).....	34	62 $\frac{1}{2}$	2 11 $\frac{1}{2}$	
" <i>Menziesii</i> (1).....	41	60 $\frac{1}{2}$	6 1	This plantation is very much exposed, so much so that a good many Larch and Scots Fir have been blown down. There is no Douglas Fir in this plantation. It will be observed that <i>Abies Menziesii</i> has far outstripped the dimensions of the other species.
" " (2).....	41	61	6 8 $\frac{1}{2}$	
" <i>Nordmanniana</i>	41	49 $\frac{1}{2}$	4 8	
" <i>Pinsapo</i>	41	37	3 2	
<i>Larix europæa</i>	41	56 $\frac{1}{2}$	3 9	
<i>Pinus austriaca</i>	41	37	4 0	
" <i>Cembra</i>	41	39	2 4 $\frac{1}{2}$	Fine old Larch in Scone Wood.
" <i>Laricio</i>	41	50	3 11	
" <i>sylvestris</i>	41	48	3 8	
<i>Larix europæa</i>	—	97 $\frac{1}{2}$	8 1	
<i>Pinus sylvestris</i>	—	74 $\frac{1}{4}$	7 10	" Scots Pine "

2. GROWING ON LYNEDOC H ESTATE.

Altitude, 340 feet. Soil, loam; subsoil, till.

Botanical Name	Age	Height	Girth at 5 ft. up	Remarks
	Years	Feet	Ft. In.	
<i>Abies Douglasii</i> (1).....	57	72 $\frac{1}{4}$	11 2	{ The Scone & Taymount plantations were raised from seed of this tree.
" " (2).....	57	92	12 0	
" <i>excelsa</i> (3).....	—	106 $\frac{1}{4}$	10 0	{ This fine tree has two leaders at 58 feet 4 inches up.
" <i>pectinata</i> (4).....	—	104 $\frac{1}{4}$	13 8	
				The largest Spruce on the estates.
				" Silver Fir "

SCONE ESTATES—*continued*.

3. GROWING ON TAYMOUNT ESTATE.

Altitude, 262 feet. Soil, moorish; subsoil, tilly.

Botanical Name	Age	Height	Girth at 5 ft. up	Remarks
<i>Abies Douglasii</i> (1).....	31	68	5 4	Plantation tree; 27 ft. to 1st branch.
" " (2).....	31	69	5 1	" 28 ft. "
" " (3).....	31	63 $\frac{1}{2}$	4 9	" 23 ft. "
" " (4).....	31	67 $\frac{1}{2}$	4 10	" 23 ft. "
" " (5).....	31	77	4 4	" 35 ft. "

4. GROWN ON LOGIE ALMOND ESTATE.

Altitude, 450 feet. Soil, light loam; subsoil, tilly.

Botanical Name	Age	Height	Girth at 5 ft. up	Remarks
<i>Abies Douglasii</i> (1).....	Years	Feet	Ft. In.	{ Plantation trees; healthy and thriving well.
" " (2).....	—	54	3 11	
" <i>Nordmanniana</i> (1)	—	50	4 0	{ Growing in the Nursery; fine handsome trees.
" " (2)	—	25	2 4	
" " (2)	—	25	2 2	{ Growing on "Almond Bank"; ten in number; age unknown.
<i>Pinus Strobus</i> (1)	—	85	6 7	
" " (2)	—	90	7 6	

GENERAL REMARKS.—All the Douglas Fir trees on the Scone estates have been raised from seed borne by No. 1 tree at Lynedoch, which was planted in 1834, and has produced fertile cones freely for many years, and is known as "the Parent tree." It contains about 200 cubic feet of timber; and its neighbour, No. 2, which stands close by and is much the finest tree, contains nearly 300 cubic feet. The large Spruce, No. 3, at Lynedoch, is a very fine tree, and contains 347 cubic feet; while the gigantic Silver Fir, No. 4, contains 480 cubic feet.

The Scone Douglas Fir plantation, about 13 acres, is on sloping ground, with a north-western exposure, and rather open to the prevailing gales. The Douglas Fir plantation at Taymount is about the same in extent as that at Scone, 13 acres, on nearly level ground, with a northern exposure, and the trees are in vigorous health and growing fast. Both those plantations are solely of Douglas Fir. The Douglas Firs at Logie Almond are somewhat sheltered by old trees. The other Conifers on the Scone estates are generally growing on a western aspect, and exposed to strong gales. Many thousands of the newer Conifers, large and small, are grown as plantation trees, and are generally of a very thrifty nature and promising appearance; but as, in most instances, only young immature trees, full of sapwood, have been available for timber purposes, it will require the experience of another generation or two to place them in their relative positions as useful timber-producing trees.

THE CAIRNIES. Major R. MALCOLM PATTON.

Altitude, 500 to 630 feet. Soil, sandy loam and moorish; subsoil, gravel and tilly.

Correspondent: Mr. JOHN MCLAGAN, Overseer, The Cairnies, Perth.

Botanical Name	Age	Height	Girth at 5 ft. up.	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	30	63	6 9	47	S.	Vigorous and thriving.
„ <i>cephalonica</i>	30	47	5 0	24	„	„ „
„ <i>concolor</i>	30	55	6 0	20	„	„ „
„ <i>Douglasii</i>	30	61	5 4	23	„	„ „
„ <i>grandis</i>	30	61	5 8	22	„	„ „
„ <i>Hookeriana</i>	30	25	1 6	9	„	Beautiful small tree.
„ <i>magnifica</i>	30	50	3 6	11	„	Vigorous and thriving.
„ <i>Menziesii</i>	35	77	6 8	25	„	„ „
„ <i>Morinda</i>	35	35	3 0	11	„	„ „
„ <i>nobilis</i>	35	65	5 9	24	„	„ „
„ <i>Nordmanniana</i> ...	35	57	4 10	22	N.	„ „
„ <i>orientalis</i>	35	50	3 3	12	S.	Fine ornamental tree.
„ <i>Pattoniana</i>	30	30	3 0	14	N.	Beautiful tree.
„ <i>Pindrow</i>	30	25	3 0	14	S.	„ slow growing.
„ <i>Pinsapo</i>	30	26	3 2	18	„	„ „
„ <i>Webbiana</i>	30	36	2 8	12	„	Fairly hardy; thrives well.
<i>Araucaria imbricata</i>	30	30	2 2	17	„	Thriving; very ornamental
<i>Cupressus Lawsoniana</i> ...	30	36	3 4	14	N.	Very hardy & ornamental.
<i>Pinus Cembra</i>	30	45	4 0	15	„	Doing fairly well.
„ <i>monticola</i>	30	70	5 3	21	„	Vigorous; fine tree.
<i>Taxodium sempervirens</i>	30	42	3 2	17	S.	Doing well in shelter.
<i>Thuja gigantea</i>	30	48	2 6	15	„	Fine fast-growing tree.
<i>Wellingtonia gigantea</i> ...	30	45	7 2	16	„	Doing well; healthy.

GENERAL REMARKS.—The trees mentioned in the above list comprise the finest of the numerous species of Conifers growing on this estate. The fastest growers are *Abies Albertiana*, *A. Douglasii*, *A. grandis*, *A. Menziesii*, *A. nobilis*, and *Pinus monticola*; and closely following them in vigour and rapidity of growth are *Abies cephalonica*, *A. concolor*, *A. magnifica*, *A. Nordmanniana*, *A. orientalis*, and *Thuja gigantea*. *Abies Pattoniana* and *A. Hookeriana* are to all appearances here the same species, and both thrive well and make very beautiful slow-growing trees. *Abies Morinda*, *A. Pindrow*, and *A. Webbiana* are fairly hardy and interesting trees at this altitude. *Abies Fraserii* and *Pinus Strobus* fail to thrive after 15 to 20 years' growth. The *Araucaria*, *Taxodium*, and *Wellingtonia* do fairly well, and are quite healthy. Lawson's Cypress does well everywhere, and is one of the hardiest of Conifers.

ROSS-SHIRE.

ARDROSS. SIR KENNETH J. MATHESON, Bart.

Altitude, 450 to 600 feet. Soil, loam and peaty; subsoil, till, gravel, and sandstone.

Correspondent: Mr. JOHN CUNNINGHAM, Forester, Ardross, Atness.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies cephalonica</i>	38	40	6 0	27	S.W.	Thrives fairly well.
" <i>Douglasii</i>	38	50	4 0	20	"	Vigorous; fine tree.
" <i>Menziesii</i>	42	56	6 0	30	W.	" "
" <i>nobilis</i>	38	48	5 8	21	"	" "
" <i>Nordmanniana</i> ...	38	36	4 3	21	S.W.	Makes a pretty tree.
" <i>orientalis</i>	38	36	4 0	18	"	" "
" <i>Pinsapo</i>	24	14	—	15	"	" "
<i>Araucaria imbricata</i> ...	38	32	5 7	20	"	Good specimen.
<i>Cedrus Deodara</i>	38	18	2 0	12	"	Slow growing.
" <i>Libani</i>	38	26	3 6	15	"	Does fairly well.
<i>Cupressus Lawsoniana</i>	24	27	3 4	15	"	Vigorous; fine tree.
<i>Pinus austriaca</i>	38	35	3 7	15	"	Doing fairly well.
" <i>Cembra</i>	38	32	3 6	18	"	" "
" <i>Jeffreyi</i>	32	30	3 8	16	"	" "
" <i>Laricio</i>	32	30	4 0	18	"	" "
<i>Thuopsis borealis</i>	52	21	2 7	9	"	Very beautiful and hardy.
<i>Wellingtonia gigantea</i>	32	26	7 6	18	"	Vigorous and healthy.

GENERAL REMARKS.—The exposure is south-west, from which quarter the heaviest gales blow past Ben Wyvis, twelve miles distant, and strike this district with great force. Still the newer Conifers, when sheltered from the direct blast, thrive well in general, and those recently planted, such as *Abies Albertiana*, *A. concolor*, *A. grandis*, and *A. magnifica*, *Cedrus atlantica*, *Pinus monticola*, and *Thuja gigantea*, in addition to those named in the list, are growing vigorously. Late spring frost is apt to kill the pushing buds of *Abies Morinda*, *A. Pindron*, and *A. Webbiana*, and in consequence they do not thrive. Larch and Scots Fir grow up to an altitude of about 1,600 feet on the mountains; but in the higher parts the young growth is liable to be injured by late spring frost, except where the ground is covered with heather, which seems to be a great preventive of injury from that cause.

BRAEMORF, LOCH BROOM. LADY FOWLER.

Correspondent : Mr. WILLIAM GUNN, Factor, Nutwood, Strathpeffer.

GENERAL REMARKS.—The growth of our trees, especially the Conifers, in 25 years, is really surprising. They grow with the greatest vigour and luxuriance, and beside the Common Larch, Scots Fir, and Spruce, which thrive well in the plantations, we have very beautiful specimens of *Wellingtonia gigantea*, *Abies Douglasii*, *A. lasiocarpa*, *A. nobilis*, *Cupressus Lawsoniana*, and other choice Conifers, all thriving well in our northern climate.

BRAHAN CASTLE. Colonel STEWART MACKENZIE.

Altitude, 160 to 200 feet. Soil, loam ; subsoil, tilly.

Correspondent : Mr. GEORGE SIMPSON, The Gardens, Brahan Castle, Conan Bridge.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	20	40	4 6	31	S.	One of the finest.
„ <i>concolor</i>	30	40	7 0	30	S.W.	A grand tree.
„ <i>Douglasii</i>	45	85	8 6	50	S.E.	„
„ <i>grandis</i>	23	26	5 2	25	S.	Healthy.
„ <i>Morinda</i>	26	25	3 9	21	S.W.	„
„ <i>nobilis</i>	35	55	7 9	36	„	Very fine tree.
„ <i>Nordmanniana</i> ...	23	32	3 6	14	S.	„
„ <i>Pinsapo</i>	30	28	3 8	18	S.W.	Very ornamental.
<i>Araucaria imbricata</i> ...	36	30	3 0	—	S.	Fine; lost lower branches.
<i>Cedrus atlantica</i>	—	48	9 0	—	S.W.	A good specimen.
„ <i>Deodara</i>	23	36	—	—	S.	All dying out.
<i>Cupressus Lawsoniana</i>	23	30	3 0	16	S.W.	A fine thriving tree.
<i>Pinus Cembra</i>	25	26	3 3	—	„	Slow growing.
„ <i>excelsa</i>	23	30	3 9	24	S.	Good specimen.
<i>Taxodium sempervirens</i>	30	32	2 8	23	S.W.	Doing moderately.
<i>Thuya Craigiana</i>	30	35	3 9	21	„	Growing freely ; fine.
<i>Thuyopsis borealis</i> ...	30	45	6 8	38	„	Beautiful tree ; very fine.
<i>Wellingtonia gigantea</i>	30	40	8 0	21	„	Thriving specimen.

CASTLE LEOD. EARL OF CROMARTY.

Altitude, 100 to 250 feet. Soil, sandy and heavy loam; subsoil, gravel and clay.

Correspondent: Mr. WILLIAM GUNN, Factor, Nutwood, Strathpeffer.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	—	35	1 9	—	N.	Healthy and fine tree.
„ <i>Douglasii</i>	—	60	5 10	—	S.	Vigorous tree.
„ <i>Menziesii</i>	—	65	6 4	—	„	„ „
„ <i>nobilis</i>	—	36	3 10	—	S.E.	„ „
„ <i>Nordmanniana</i> ...	13	20	1 4	—	„	Beautiful young tree.
<i>Araucaria imbricata</i> ...	—	35	4 2	—	W.	Fine specimen.
<i>Cedrus Deodara</i>	—	33	5 0	—	S.E.	„ „
<i>Cupressus Lawsoniana</i>	—	26	3 6	—	„	„ „
<i>Libocedrus decurrens</i> ...	13	10	0 8	—	„	Fine young tree.
<i>Pinus Cembra</i>	—	31	5 3	—	S.	Fine specimen.
<i>Taxodium sempervirens</i>	—	42	6 6	—	„	„ „
<i>Thuyopsis borealis</i>	—	35	3 0	—	„	A very beautiful tree.
<i>Wellingtonia gigantea</i> ..	—	61	10 3	—	W.	A splendid specimen.

CONAN HOUSE. Sir KENNETH S. MACKENZIE, Bart.

Altitude, 200 feet. Soil, light loam; subsoil, sandy.

Correspondent: Mr. WILLIAM HILLOAK, The Gardens, Conan House, Conan.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies cephalonica</i>	34	48	4 9	—	N.	Good specimen.
„ <i>Douglasii</i>	28	77	5 4	—	Shelt.	Vigorous; fast grower.
„ <i>grandis</i>	18	52	5 0	—	N.	Vigorous; fine tree.
„ <i>Menziesii</i>	22	53	5 10	—	„	„ „
„ <i>nobilis</i>	20	50	3 3	—	„	„ „
„ <i>Nordmanniana</i> ...	20	43	2 7	—	„	„ „
„ <i>pectinata</i>	80	65	10 1	—	„	Fine old tree.
„ <i>Pindrow</i>	27	31	3 2	—	„	A good specimen.
„ <i>Pinsapo</i>	25	35	3 6	—	„	Ornamental; lost leader.
<i>Araucaria imbricata</i> ...	43	42	4 2	—	S.	Fine specimen; bearing
<i>Cedrus Deodara</i>	35	35	5 1	—	Open.	„ „ [cones.
<i>Cupressus Lawsoniana</i> ..	22	33	2 6	—	N.	„ „
<i>Larix europæa</i>	80	96	8 4	—	„	Fine old tree.
<i>Sciadopitys verticillata</i>	15	7	—	—	„	Slow growing; interesting.
<i>Thuyopsis borealis</i>	15	23	—	—	„	Healthy and very graceful.
<i>Wellingtonia gigantea</i> ..	18	38	5 3	—	S.	Vigorous and healthy.

GENERAL REMARKS.—The *Araucaria* has at present 52 cones, which are getting brown, and promise to ripen. About ten years ago a cone ripened seeds, from which young trees were raised that are now about 3 ft. high, and very healthy. The Douglas Fir succeeds best in sheltered places; when exposed the trees lose their symmetry, and the leader is apt to be broken off by the wind.

COUL HOUSE, STRATHPEFFER. Sir ARTHUR RAMSAY MACKENZIE, Bart.

Altitude, 100 feet. Soil, light loam; subsoil, sandy.

Correspondent: Sir ARTHUR RAMSAY MACKENZIE, Bart., of Coul, Dingwall.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	60	72	10 10	51	S.	Very fine specimen.
" <i>nobilis</i>	60	77	7 10	34	S.W.	" "
<i>Cupressus Lawsoniana</i> ..	28	30	3 4	19	"	Beautiful tree.
<i>Thuja gigantea</i>	30	42	3 3	24	"	" "
<i>Wellingtonia gigantea</i>	30	55	7 10	23	"	Handsome tree.

GENERAL REMARKS.—Both *Abies Douglasii* and *A. nobilis* are beautiful and healthy trees planted by Sir George Mackenzie of Coul, seventh Baronet, and are believed to have been raised from the first seed of them imported into this country. All the specimens are of remarkably healthy and vigorous growth.

DUNCRAIG. Sir KENNETH J. MATHESON, Bart.

Altitude, 30 to 100 feet. Soil, loam and peaty; subsoil, gravel and rocky.

Correspondent: Mr. ALEXANDER STEWART, The Gardens, Duncraig, Strone Ferry.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	23	38	4 0	—	N.W.	Fine thriving tree.
" <i>nobilis</i>	23	46	3 6	—	"	Very flourishing.
" <i>Nordmanniana</i> ...	23	45	4 4	—	"	" "
<i>Araucaria imbricata</i> ...	23	36	3 1	—	N.E.	" "
<i>Cupressus Lawsoniana</i>	23	15	1 6	—	N.W.	Nice tree.
<i>Pinus excelsa</i>	23	25	2 0	—	"	Free growing.
<i>Wellingtonia gigantea</i>	23	40	5 6	—	"	Fine tree; very flourishing.

GENERAL REMARKS.—All the Conifers here are in a remarkably healthy and flourishing condition. They are among the finest in West Ross-shire, and are greatly admired for their free growth and vigorous appearance.

SELKIRKSHIRE.

SUNDERLAND HALL. MRS. SCOTT PLUMMER.

Altitude, 150 feet. Soil, light loam ; subsoil, gravel.

Correspondent : WILLIAM G. PIRIE, The Gardens, Sunderland Hall, Selkirk.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	21	44	3 2	18	W.	Very vigorous & healthy.
" <i>Nordmanniana</i> ...	26	36	3 3	18	S.	
<i>Cupressus Lawsoniana</i> ...	25	33	3 0	16	N.W.	Grows freely & graceful.
<i>Wellingtonia gigantea</i> ...	30	51	6 2	15	S.E.	Vigorous and handsome.

GENERAL REMARKS.—Many younger plants are thriving well, and promise in time to be fine trees.

STIRLINGSHIRE.

BUCHANAN CASTLE. DUKE OF MONTROSE.

Altitude, 120 feet. Soil, loam ; subsoil, tilly.

Correspondent : Mr. ALEX. CROSBIE, The Gardens, Buchanan Castle, Drymen.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	25	45	3 6	22	S.	Fine elegant habit.
" <i>canadensis</i>	—	45	6 10	—	"	A fine clean stem.
" <i>Douglasii</i>	—	85	12 0	50	Sheld.	Fine healthy tree.
" <i>Menziesii</i>	35	65	9 0	35	"	Fine specimen.
" <i>nobilis</i>	35	72	6 7	40	"	Very fine specimen.
" <i>Nordmanniana</i> ...	35	50	7 2	35	"	A handsome tree.
<i>Araucaria imbricata</i>	35	43	5 4	22	"	Very fine specimen.
<i>Cedrus atlantica</i>	35	55	3 9	24	"	Healthy & free growing.
" <i>Deodara</i>	35	45	5 2	24	"	Fine specimen.
<i>Cupressus Lawsoniana</i> ...	30	42	3 7	20	"	Thrives vigorously.
" <i>erecta viridis</i>	7	9	4 0	4	"	Very pretty and effective.
<i>Pinus austriaca</i>	35	50	3 2	—	"	Healthy.
" <i>Benthamiana</i>	30	43	2 7	—	"	Slow growing.
" <i>excelsa</i>	35	50	4 8	20	"	Very good specimen.
" <i>monticola</i>	35	55	5 4	22	"	Very fine tree.
<i>Taxodium sempervirens</i>	35	33	7 8	30	"	Healthy tree.
<i>Thuja gigantea</i>	25	28	4 4	15	"	Fine specimen.
<i>Thuyopsis borealis</i>	25	25	2 6	12	"	Beautiful tree.
" <i>dolabrata</i>	25	12	—	4	"	Beautiful small tree.
<i>Wellingtonia gigantea</i> ...	34	60	9 8	20	"	Vigorous and healthy ; very fine.

GENERAL REMARKS.—Besides those noted above, many Biotas, Retinosporas, Thuyas, Junipers, and Yews are thriving well, and forming fine specimens. *Abies excelsa* *Clanbrasiliana* forms a very neat "table-topped" dwarf tree, 4 feet high and 5 feet through. Among the older trees in the Castle grounds are a Yew, 40 feet high and 11 feet 6 inches in girth; a Silver Fir, 10 feet; a number of very fine Scots Firs, from 8 to 9 feet; an Oak, 19 feet; Ash, 17 feet 6 inches, and a Spanish Chestnut, 12 feet 6 inches, all at 5 feet up.

SUTHERLANDSHIRE.

DORNOCH. DUKE OF SUTHERLAND.

Correspondent: Mr. JAMES B. KIDD, Forester, The Poles, Dornoch.

GENERAL REMARKS.—In 1878, when I came to Dornoch, there was not a Conifer beyond the common trees—Larch, Scots Fir, Spruce, and Silver Fir—in the Dornoch, Criche, Linside, Lairg, Lochinver, and Tongue districts, an area of about sixty square miles. Within recent years, however, we have planted extensively of *Abies Douglasii*, *A. nobilis*, *A. Nordmanniana*, *Pinus Cembra*, and *Thuja gigantea*, with highly gratifying results. Among others that have been planted, and all of which are thriving well, are *Abies Albertiana*, *A. Aleoekiana*, *A. amabilis*, (?) *A. canadensis*, *A. cephalonica*, *A. concolor*, *A. Engelmannii*, *A. excelsa finlandensis*, *A. Fraserii*, *A. grandis*, *A. Lowii*, *A. magnifica*, *A. Menziesii*, *A. Morinda*, *A. Parryana glauca*, *A. Pinsapo*, *A. Schrenkiana*, *A. Webbiana*; *Cedrus atlantica*, *C. Deodara*, *C. Libani*; *Pinus austriaca*, *P. Jeffreyi*, *P. Laricio*, *P. monticola*, *P. Strobus*, *Thuyopsis borealis*, and *Wellingtonia gigantea*. I may say that the more tender kinds are always planted in well-sheltered spots, and none at a greater altitude than 430 feet. Some of them make remarkably fine growth, and all of them are in vigorous health. The Douglas Fir has made over 3 feet of leading shoot in a season, and *A. nobilis* about 2 feet. Even Webb's Fir, a native of the Himalayan mountains, and not usually considered hardy in Britain, thrives splendidly, and makes a very robust terminal growth of 18 to 20 inches in the year. Altogether, the success which has so far attended the planting of the newer Conifers in this district gives great promise of good results when they attain their full size and maturity.

DUNROBIN. DUKE OF SUTHERLAND.

Altitude, 20 to 60 feet. Soil, light loam; subsoil, gravelly.

Correspondent: Mr. DAVID MELVILLE, The Gardens, Dunrobin Castle, Golspie.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks.
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	40	58	10 10	62	N.W.	Healthy spreading tree.
" <i>nobilis</i>	18	28	2 9	23	"	Fine vigorous tree.
<i>Araucaria imbricata</i> ...	38	33	5 4	28	"	One of a row of fine trees, all about the same height.
<i>Cedrus atlantica</i>	30	27	2 11	18	S.W.	Planted by Chas. Sumner.
" <i>Deodara</i>	35	34	5 1	25	W.	A nice specimen.
" <i>Libani</i>	30	29	3 10½	30	S.W.	Planted by Mrs. Harriet Beecher Stowe.
<i>Wellingtonia gigantea</i>	30	38	5 1	15	"	Planted by H.R.H. the Prince of Wales.

GENERAL REMARKS.—Dunrobin is so near to the German Ocean, and so fully exposed to the parching easterly gales which blow from off the sea with injurious effect in the summer months, that Conifers require to be grown in sheltered places to succeed well. In such places the specimens of which I have given details are thriving admirably; and so are many others of these and other species.

which have been more recently planted. *Abies Albertiana*, *A. Menziesii*, *A. nobilis*, *A. Nordmanniana*, *Cupressus Lawsoniana*, *C. macrocarpa*, *Thuja gigantea*, *Thuyopsis borealis*, and others, are fine healthy young specimens from 10 to 20 feet high. Farther inland, in Sutherland, Conifers thrive well, and a considerable extent of Larch and Scots Fir has been planted in later times. In making plantations of Scots Fir on peaty ground, it has been observed that where the roots get hold of the gravel, or firm subsoil, the trees come away freely and thrive well; but on deep peat, where the roots cannot soon reach a firm subsoil, the trees make little progress, and in many instances die off entirely. In the Dornoch district there are some fine old woods, now yielding good returns, which have been planted on fairly level ground, in a somewhat thin, peaty soil. Natural re-afforestation is being tried there to a considerable extent.

WEST LOTHIAN.

HOPETOUN. EARL OF HOPETOUN.

Altitude, 250 feet. Soil, sandy loam; subsoil, tilly.

Correspondent: Mr. JAMES SMITH, The Gardens, Hopetoun House, South Queensferry.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	37	52	3 7	26	N.	Very healthy and fine.
„ <i>concolor</i>	30	34	3 2	18	„	Not very healthy.
„ <i>Douglasii</i>	—	82	7 2	40	„	Very healthy; does not stand the wind.
„ <i>grandis</i>	30	40	2 5	21	„	Vigorous and healthy.
„ <i>magnifica</i>	15	16	1 4	9	„	Healthy; pretty tree.
„ <i>Menziesii</i>	30	35	3 0	24	„	Moderately vigorous.
„ <i>nobilis</i>	35	45	4 8	24	„	Very healthy; fine tree.
„ <i>Smithiana</i> (1) ..	70	76	8 0	33	„	One of the orig. seedlings; a very fine healthy tree.
„ „ (2) ..	65	60	7 4	29	„	Grt'd. on Norway Spruce; fine, fairly healthy.
<i>Araucaria imbricata</i> ...	30	33	3 6	22	„	Healthy; fine specimen.
<i>Cedrus atlantica</i>	—	59	6 8	45	„	Very fine and healthy.
„ <i>Deodara</i>	—	48	8 9	36	„	Very healthy.
<i>Cupressus Lawsoniana</i>	23	26	2 9	12	„	„
<i>Pinus austriaca</i>	30	35	4 7	28	„	„
„ <i>Cembra</i>	25	28	2 4	16	„	Good specimen.
„ <i>excelsa</i>	25	30	3 0	23	„	„
„ <i>Laricio</i>	70	71	7 3	40	„	Fine tree; very healthy.
„ <i>ponderosa</i>	25	28	2 8	14	„	Not very healthy.
„ <i>Strobus nana</i> ...	30	7	2 0	7	„	Healthy; dwarf tree.
<i>Taxodium sempervirens</i>	35	46	4 6	18	„	Fine graceful tree.
<i>Thuja gigantea</i>	30	42	2 10	16	„	Free growing; fine.
<i>Thuyopsis borealis</i>	30	33	2 4	12	„	Very healthy; graceful tree.
<i>Wellingtonia gigantea</i>	35	40	6 8	17	„	Healthy; good specimen.

GENERAL REMARKS.—The above specimens are all growing in the pinetum and grounds at Hopetoun, and most of them are in a healthy, thriving condition. The specimens of *Abies Smithiana*, or *A. Morinda*, are interesting from the fact that No. 1 is one of the first six plants raised in this country from seed sent to the Earl of Hopetoun by Dr. Govan of Cupar, Fife, in 1818. The seeds were

sown and the plants raised by a namesake of my own, James Smith, then gardener at Hopetoun. He afterwards planted two of them in the grounds here; one was sent to the Royal Horticultural Society; and the other three to the Edinburgh Botanic Garden. To increase their number at Hopetoun, he grafted it upon the Norway Spruce, on which some did fairly well. No. 2 is the finest of the grafted trees still extant, and is mentioned by Loudon as being grafted in 1826, and 10 feet high in 1837. Wallich named the species *Smithiana*, after the raiser.

WIGTONSHIRE.

CASTLE KENNEDY. EARL OF STAIR.

Altitude, 100 feet. Soil, sandy loam; subsoil, gravel.

Correspondent: Mr. JAMES HOGARTH, Forester, Culhorn, Stranraer.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Pt.	In.		
<i>Abies Albertiana</i>	35	32	3	6	24	S.W. Vigorous and graceful.
„ <i>Alcockiana</i>	20	32	1	9	16	„ Ornamental; rapid grower.
„ <i>bracteata</i>	30	25	2	9	18	„ Fairly hardy; interesting.
„ <i>cephalonica</i>	42	42	7	0	35	„ Healthy; good specimen.
„ <i>concolor</i>	35	36	4	0	15	„ „ handsome tree.
„ <i>Douglasii</i>	40	55	4	4	20	„ Loses leader from gales.
„ <i>grandis</i>	12	30	1	7	14	„ Fast grower; fine tree.
„ <i>magnifica</i>	35	36	3	0	9	„ Very handsome tree.
„ <i>Morinda</i>	40	50	4	10	24	„ Gracefully droopg. brnchs.
„ <i>nobilis</i>	40	50	7	0	30	„ Vigorous and handsome.
„ <i>Nordmanniana</i> ..	30	35	3	9	18	„ „
„ <i>Pindrow</i>	35	38	3	2	14	„ Grows freely; fine tree.
„ <i>Webbiana</i>	35	36	3	5	18	„ „
<i>Arancaria imbricata</i> ...	42	40	5	6	25	„ Vigorous; many fine trees.
<i>Cedrus atlantica</i>	36	32	3	5	18	„ Moderate grower.
„ <i>Deodara</i>	40	40	4	9	30	„ „
<i>Cryptomeria japonica</i> ...	35	40	4	0	18	„ Fine graceful tree.
<i>Cupressus Lawsoniana</i>	30	27	3	3	12	„ Very hardy and free.
„ <i>macrocarpa</i>	35	55	8	8	32	„ Beautiful tree; grows rapidly; forms heart-wood quickly.
<i>Pinus austriaca</i>	42	45	6	6	24	„ Healthy.
„ <i>Cembra</i>	30	30	3	4	15	„ „
„ <i>excelsa</i>	40	37	4	8	28	„ „
„ <i>insignis</i>	42	52	7	9	36	„ Very fine, & free growing.
„ <i>Laricio</i>	42	48	5	8	20	„ Free grower.
„ <i>monticola</i>	20	32	2	3	12	„ Fine fast growing tree.
„ <i>ponderosa</i>	42	38	4	4	22	„ Vigorous.
<i>Taxodium sempervirens</i>	35	34	5	10	18	„ „
<i>Thuja gigantea</i>	30	35	3	8	18	„ „ rapid grower.
<i>Thuyopsis borealis</i>	25	21	2	0	14	„ Fine graceful habit.
<i>Wellingtonia gigantea</i>	30	33	8	6	20	„ Vigorous; grows well.

GENERAL REMARKS.—The above trees are all growing in the ornamental grounds at Castle Kennedy, along with thousands of others, and, the site and soil being fairly suitable, most of them are thriving well and making rapid growth in the moist and mild climate of this district.

IRELAND.

III.—STATISTICS OF CONIFERS IN IRELAND.

ANTRIM.

SHANE'S CASTLE. LORD O'NEILL.

Altitude, 60 to 100 feet. Soil, loam ; subsoil, clay and rock.

Correspondent : MR. CHARLES WARWICK, The Gardens, Shane's Castle, Antrim.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Year	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	27	49	3 11	22	E.	Beautiful tree; grows fast.
„ <i>Douglasii</i>	40	34	5 9	38	W.	Top blown off 7 years ago.
„ <i>grandis</i>	29	19	1 8	16	S.	Loses its foliage every winter.
„ <i>magnifica</i>	27	35	3 2	10	„	Fine thriving tree.
„ <i>Menziesii</i>	40	71	9 0	45	W.	Stands cold winds well.
„ <i>Morinda</i>	40	52	6 2	30	S.	Requires shelter.
„ <i>nobilis</i>	27	50	4 3	20	S.E.	Grafted tree; very fine.
„ <i>Nordmanniana</i> ...	27	30	3 4	23	S.	Grows freely
<i>Araucaria imbricata</i> ...	45	35	5 9	30	„	Well sheltered
<i>Cedrus Deodara</i>	27	20	1 6	12	W.	Does not thrive here.
<i>Cryptomeria japonica</i> ...	32	38	6 0	27	S.	A fine specimen.
<i>Cupressus Lawsoniana</i>	27	32	2 10	14	S.W.	Fine thriving tree.
<i>Pinus austriaca</i>	45	55	11 9	44	S.	„
„ <i>Cembra</i>	32	41	3 9	17	E.	Grows rapidly here.
<i>Taxodium sempervirens</i>	26	53	7 2	29	S.	„
<i>Thuja gigantea</i>	26	62	5 2	24	E.	Very fast grower, and fine.
<i>Thuyopsis borealis</i> ...	26	23	3 0	20	W.	Beautiful; grows well.
<i>Wellingtonia gigantea</i>	26	36	7 9	28	E.	Very fine specimen.

GENERAL REMARKS.—Conifers as a rule thrive well with us, especially when sheltered from the cold cutting winds which so frequently blow here through the winter and spring. *Abies Menziesii* is among the best of the Spruces and Firs for standing the blast, and grows robustly in any situation. *Thuja gigantea* grows very rapidly, and both it and *Thuyopsis borealis* are very graceful and hardy trees, thriving well in all situations. The *Wellingtonia* of which the dimensions are given is a very fine tree at its age, and, growing in a warm and well-sheltered spot, it promises to become one of the finest specimens in the North of Ireland.

CORK.

FOTA ISLAND. A. H. SMITH BARRY, Esq.

Altitude, 4 to 20 feet. Soil, light loam; subsoil, marl.

Correspondent: Mr. WILLIAM OSBORNE, The Gardens, Fota, Carrigtwohill.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	—	10	—	9	Open.	Very ornamental.
„ <i>concolor</i>	—	10	—	6	„	Will not stand high winds
„ <i>Douglasii</i>	—	80	6 3	30	„	Very ornamental; quick growing.
„ <i>grandis</i>	—	40	2 6	18	„	Very ornamental; distinct from <i>A. concolor</i> .
„ <i>lasiocarpa</i>	—	30	1 10	10	„	Very ornamental.
„ <i>magnifica</i>	—	8	—	5	„	Fast growing; healthy.
„ <i>Menziesii</i>	—	60	5 6	25	„	„ very beautiful.
„ <i>nobilis</i>	—	65	4 6	12	„	Very ornamental.
„ <i>Nordmanniana</i> ...	—	30	2 0	14	„	Lovely trees.
„ <i>orientalis</i>	—	30	1 9	12	„	„ hardy here.
„ <i>religiosa</i>	—	60	3 6	—	„	Beautiful in spring.
„ <i>Smithiana</i>	—	62	4 3	20	„	Very ornamental; cones.
„ <i>Webbiana</i>	—	30	2 6	18	„	Ornmt.; cones & ripens.
<i>Araucaria imbricata</i>	—	45	5 2	18	„	„
<i>Cedrus atlantica</i>	—	50	5 0	30	„	„
„ <i>Deodara</i>	—	65	6 0	35	„	„
<i>Cryptomeria japonica</i> ...	—	56	3 6	20	„	Most ornamental trees.
„ „ <i>Lobbii</i>	—	54	3 0	16	„	„
<i>Cupressus Lawsoniana</i> ...	—	20	—	10	„	„
„ <i>macrocarpa</i> ...	—	76	—	45	„	„
<i>Pinus excelsa</i>	—	45	—	20	„	„
„ <i>insignis</i>	—	65	8 0	55	„	„
„ <i>Laricio</i>	—	70	—	30	„	Not very ornamental.
„ <i>ponderosa</i>	—	20	—	12	„	„
<i>Taxodium sempervirens</i>	—	75	7 6	25	„	Free growing; fine tree.
<i>Thuya gigantea</i>	—	56	4 0	27	„	Quick growing; beautiful tree.
<i>Thuyopsis borealis</i>	—	22	—	12	„	Most ornamental tree.
<i>Wellingtonia gigantea</i> ...	—	60	5 0	12	„	„

GENERAL REMARKS.—All the Conifers at Fota are growing at a low altitude, some of them only a foot or two above high-water mark. *Sequoia* (*Taxodium*) *sempervirens* is growing in swampy land reclaimed from the sea, and does remarkably well, being among the largest of the newer Conifers growing on Fota Island. *Pinus insignis* is the handsomest and freest-growing of all the Pines we have, and thrives well near the sea, making sometimes a growth of 4 feet in a season. *Cupressus macrocarpa* also grows vigorously along with *P. insignis*, and forms a very beautiful tree. All the Cypresses that grow in Britain thrive well here, and are very ornamental. The Cedars and *Araucaria imbricata* bear cones and ripen seed regularly. Most of the *Abies* are lovely trees, and are indispensable in all ornamental grounds. In addition to those named in the list, I may mention that fine trees are growing here of *Abies Alcockiana*, which should be in every collection; *A. bracteata*, a very quick-growing ornamental tree, which has borne cones here; *A. Engelmannii glauca*, a most desirable and perfectly hardy Spruce; and *A. numidica*, a beautiful deep

gigantea, a very quick-growing tree, and *Thuyopsis borealis* are among the very finest of ornamental species. Among Pines, *P. excelsa* forms a fine silvery-tinted tree and grows freely; but, perhaps, of all the Pines growing here *P. Devoniana* is the most beautiful, its graceful outlines and long drooping grass-green foliage never failing to attract the notice of the most careless observer.

DOWN.

CASTLEWELLAN. EARL OF ANNESLEY.

Altitude, 100 feet. Soil, light loam and peaty; subsoil, gravel.

Correspondent: Mr. T. RYAN, The Gardens, Castlewellan.

Botanical Name	Age	Height	Diameter of Branches	Remarks
	Years	Feet	Feet	
<i>Abies Albertiana</i>	14	30	—	A most graceful tree.
„ <i>Alcockiana</i>	—	20	—	Very distinct; requires shelter.
„ <i>brachyphylla</i>	—	14	14	Fine ornamental tree.
„ <i>bracteata</i>	—	12	—	„ „ healthy.
„ <i>concolor violacea</i> ...	—	8	—	„ „ does well.
„ <i>Douglasii</i>	—	100	42	Splendidly feathered specimen.
„ „ <i>Stairii</i>	—	18	—	A good variegated variety.
„ <i>grandis</i>	—	43	35	Very fine; coned two years ago.
„ <i>Hookeriana</i>	—	18	—	Beautiful tree.
„ <i>lasiocarpa</i>	—	25	15	„
„ <i>magnifica</i>	14	27	12	Not reliable.
„ <i>nobilis</i>	—	40	—	One of the best.
„ <i>Nordmanniana</i>	—	33	—	Handsome; cones frequently.
„ <i>numidica</i>	—	12	—	Beautifully feathered to ground.
„ <i>Veitchii</i>	—	12	—	Very distinct, and free growing.
<i>Araucaria imbricata</i>	—	42	—	Fine tree; coned this season.
<i>Athrotaxis selaginoides</i> ...	—	14	—	Good specimen; requires shelter.
<i>Cedrus Deodara</i>	—	47	36	„ sheltered.
<i>Cryptomeria elegans</i>	—	16	21	Very fine specimens.
„ „ <i>japonica</i>	—	46	33	„
<i>Cupressus Lawsoniana</i> ...	—	46	23	Beautiful specimen.
„ „ <i>erecta viridis</i>	—	19	—	Very effective variety.
„ „ <i>gracilis aurea</i>	—	9	6	„
„ „ <i>lutea</i>	—	11	—	„
„ „ <i>macrocarpa</i>	—	70	32	Very fine vigorous tree.
<i>Dacrydium Frankii</i>	—	8	—	A famed Tasmanian tree.
<i>Juniperus recurva</i>	—	28	30	Very fine specimen; on cool bottom.
<i>Larix Kämpferi</i>	—	10	20	Fine spreading specimen.
<i>Libocedrus chilensis</i>	—	12	7	Handsome, healthy tree.
<i>Pinus insignis</i>	—	65	—	Exposed; one of the best of Pines.
<i>Podocarpus andinus</i>	—	10	8	A fine ornamental tree.
<i>Retinospora filifera</i>	—	12	15	Very fine specimen.
„ „ <i>plumosa aurea</i>	—	10	11	„
<i>Sciadopitys verticillata</i> ...	—	10	—	Very interesting specimen.
<i>Thuya Lobbii</i>	16	35	10	Very fast growing tree.
„ „ <i>arrovirens</i>	—	14	—	„
„ „ <i>Standishii</i>	—	12	9	Beautiful specimen.
„ „ <i>Vervaeckiana</i>	—	12	10	Fine variety of <i>T. occidentalis</i> .
<i>Thuyopsis borealis</i>	—	23	18	Very graceful and free growing.
„ „ <i>dolabrata</i>	—	20	14	Very handsome specimens.
<i>Wellingtonia gigantea</i> ...	—	69	20	16 ft. girth at 5 ft. up; grand tree.
„ „ <i>variegata</i>	—	18	21	Very fine healthy specimen.

GENERAL REMARKS.—Conifers on the whole do very well here. They have been planted somewhat extensively by the Earl of Annesley, who takes a keen interest in their progress, and many of them are making splendid growth. The Wellingtonia mentioned in the list is a very handsome tree, and growing vigorously. It is considered to be the finest specimen in the kingdom. Most of the specimens named in the table are growing in the gardens, at an altitude of about 100 feet, and well sheltered with old deciduous trees; the Mourne Mountains rising to the north and west and affording great protection from those quarters. It is doubtful if in this climate many of the newer Conifers will ever become useful timber trees; but for all landscape work, and the decoration of pleasure grounds, they are indispensable, and ought to be extensively used for such purposes.

GALWAY.

CLONBROCK. LORD CLONBROCK.

Altitude, 200 feet. Soil, yellow loam; subsoil, stiff marl.

Correspondent: Mr. JAMES MCKENZIE, The Gardens, Clonbrock, Ballinasloe.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	12	24	2 5	21	Sheld.	Fine fast-growing tree.
„ <i>Menziesii</i>	10	24	1 3	15	„	Very „
„ <i>Nordmanniana</i> ...	13	18	1 4	12	„	Makes a fine specimen.
<i>Cedrus Deodara</i>	35	47	4 6	27	„	Very handsome.
<i>Cupressus Lawsoniana</i>	12	22	2 1	22	„	Graceful and fast growing.
<i>Pinus excelsa</i>	35	58	6 3	43	„	Beautiful tree.
„ <i>insignis</i>	35	74	10 8	50	„	Very fast grower.
<i>Taxodium sempervirens</i>	35	40	6 0	21	„	Good specimen.
<i>Thuja gigantea</i>	20	33	3 3	23	„	Beautiful specimen.
<i>Thuyopsis borealis</i>	25	22	1 9	19	„	„ „
<i>Wellingtonia gigantea</i>	35	42	8 4	28	„	„ „

GENERAL REMARKS.—Most of the above specimens are growing in the woods here, generally in well-sheltered spots, and they are growing with great luxuriance. We have many more younger trees of the same and other species of Conifers, planted out in the woods, where they are thriving well, and promise at an early period to be useful as well as very ornamental trees.

GARBALLY. EARL OF CLANCARTY.

Altitude, 150 to 250 feet. Soil, light loam ; subsoil, gravel.

Correspondent : Mr. JOHN COBBAN, The Gardens, Garbally, Ballinasloe.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies concolor</i>	36	40	3 6	20	open.	Very handsome specimen.
„ <i>grandis</i>	36	43	3 6	20	„	„
„ <i>nobilis</i>	33	42	3 0	16	sheldt.	Good specimen. „
„ <i>Nordmanniana</i> ...	22	33	2 4	16	„	Very fine, in perfect health
<i>Araucaria imbricata</i> ...	25	30	2 2	12	„	„
<i>Cedrus atlantica</i>	30	40	2 1	21	„	„
„ <i>Deodara</i>	50	55	6 0	33	„	„
<i>Cryptomeria japonica</i> ...	35	45	2 3	17	„	„
<i>Cupressus Lawsoniana</i>	25	33	4 4	25	„	„
„ <i>erecta viridis</i>	25	24	—	7	„	A striking variety.
„ „ <i>gracilis</i>	16	15	—	9	„	A perfect specimen.
„ <i>macrocarpa</i> ...	25	36	—	31	„	„
<i>Pinus Cembra</i>	40	50	6 8	46	„	„
<i>Thuja gigantea</i>	33	50	4 4	43	„	„
<i>Thuyopsis borealis</i>	17	20	—	12	„	Beautiful specimen.
<i>Wellingtonia gigantea</i>	33	50	6 4	33	„	A perfect specimen.

GENERAL REMARKS.—The newer Conifers have been planted here in considerable numbers within the past dozen years, and in the light gritty loam with an open gravelly bottom, they are almost without exception thriving with remarkable vigour. The specimens of which the details are given in the table are among the earliest planted, and the largest here of their kind ; and, generally, they are extremely handsome trees, in perfect health. The first two specimens mentioned in the table, *Abies concolor* and *A. grandis*, have had their side branches pruned in slightly several times, owing to want of space to allow them to spread, and they seem to like the treatment, as they are beautiful, close, well-furnished conical trees, in perfect health, and very attractive objects in the spot where they grow.

KYLEMORE CASTLE. MITCHELL HENRY, Esq.

Altitude, 100 feet. Soil, peaty; subsoil, gravelly clay.

Correspondent: Mr. WILLIAM FARMER, The Castle Gardens, Kylemore.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	15	14	0 10	10	S.	Doing well; healthy.
„ <i>Douglasii</i>	25	35	3 2	21	„	Fine vigorous specimen.
„ <i>nobilis</i>	25	45	4 9	24	„	Fine; lost lower branches.
„ <i>Nordmanniana</i> ...	25	40	3 2	22	„	Nicely furnished spec.
„ <i>polita</i>	15	10	0 10	8	„	Doing well; healthy.
<i>Araucaria imbricata</i> ...	20	28	2 5	18	„	Very fine specimen.
<i>Cedrus Deodara</i>	13	15	1 1	10	„	Does fairly well.
<i>Cupressus Lawsoniana</i>	20	20	2 4	14	„	Healthy and thriving.
„ <i>macrocarpa</i>	20	48	6 0	30	„	Very vigorous specimen.
<i>Pinus excelsa</i>	15	12	0 9	9	„	Doing well.
„ <i>insignis</i>	25	56	6 6	33	„	Very vigorous growing.
„ <i>Laricio</i>	25	35	2 6	16	„	Lost lwr. branches; rough.
<i>Wellingtonia gigantea</i>	25	40	4 6	20	„	Fairly good specimen.

GENERAL REMARKS.—The Pinetum here, in which most of the above specimens are growing, is well sheltered from the north, but fully exposed to the south, east, and west. The greatest evil which Conifers have to contend with in the west of Connemara is the strong salt-laden breeze which sweeps in from the Atlantic, and where it hits them with its full force, comparatively few of them thrive well under it. By far the best of all the species of Conifers growing here for withstanding the salt breeze are *Pinus insignis* and *Cupressus macrocarpa*, which seem to grow with increased vigour under its influence, and have far outstripped all other Conifers in their growth. Both are perfectly hardy here, and the saline-laden gales which we so often experience have no injurious effect on these two valuable trees. *Abies polita* is among the best of the Spruces for standing the salt breeze. Where they are well sheltered from the maritime gales, most of the newer Conifers thrive well in Connemara.

KERRY.

KILLARNEY. EARL OF KENMARE.

Altitude, various. Soil, loam and peat; subsoil, gravel and rock.

Correspondent: MR. GEORGE M. BREESE, The Gardens, Killarney House, Killarney.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	—	65	7 6	44	Sheld.	Very fine tree.
„ <i>Menziesii</i>	—	50	5 11	26	„	Not thriving well.
„ <i>nobilis</i>	—	46	7 6	36	„	Very fine healthy tree.
„ <i>Nordmanniana</i> ...	—	50	10 6	60	„	„
<i>Araucaria imbricata</i>	—	40	4 6	25	„	Splendid specimen.
<i>Cupressus Lawsoniana</i> ...	—	46	6 2	21	„	„
<i>Pinus austriaca</i>	—	45	8 6	55	Open.	More exposed than others
„ <i>insignis</i>	—	65	12 2	66	Sheld.	A magnificent tree.
<i>Wellingtonia gigantea</i> ...	—	55	12 0	33	„	A handsome specimen.

GENERAL REMARKS.—Conifers, as a rule, thrive well in sheltered places in the County of Kerry. The specimens of which the details are given above are among the finest in the neighbourhood. Many other species are planted and thriving well, but they are yet too young to record their dimensions as being of special interest.

KILDARE.

CARTON. DUKE OF LEINSTER.

Altitude, 80 feet. Soil, deep loam; subsoil, clay.

Correspondent: Mr. ALEXANDER ELACK, The Gardens, Carton, Maynooth.

Botanical Name	Age	Height	Girth at 5 ft. up		Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft.	In.	Feet		
<i>Abies Douglasii</i>	—	63	6	0	29	W.	Very fine specimen.
„ <i>grandis</i>	—	80	6	0	34	„	„ rapid grower.
„ <i>nobilis</i>	—	33	4	0	21	S.E.	Handsome tree.
„ <i>Nordmanniana</i> ...	—	34	2	6	15	S.	„
„ <i>pectinata</i>	—	111	15	6	97	N.W.	Fine old specimen.
„ <i>Pinsapo</i>	—	38	3	6	18	N.E.	Handsome tree.
<i>Aruncaria imbricata</i>	—	15	1	9	12	S.	Thriving.
<i>Cedrus atlantica</i>	—	56	8	0	53	S.E.	Grand specimen.
„ <i>Deodara</i>	—	37	2	6	28	„	Beautiful; doing well.
„ <i>Libani</i>	—	76	14	0	79	S.	Grand old specimen.
„ „.....	—	72	14	0	88	S.W.	„
<i>Cryptomeria elegans</i> ...	—	16	2	0	10	S.	Very effective.
<i>Cupressus Lawsoniana</i> ...	—	35	4	0	19	„	Free growing; graceful.
<i>Juniperus excelsa</i>	—	17	1	0	5	W.	Handsome.
<i>Pinus Cembra</i>	—	37	4	0	17	„	„
„ <i>excelsa</i>	—	40	4	0	20	S.E.	„
„ <i>insignis</i>	—	47	6	0	38	W.	Strong growing; fine tree
<i>Taxodium sempervirens</i>	—	28	5	6	30	S.W.	Doing well.
<i>Taxus baccata</i>	—	32	—	—	66	N.W.	Fine specimen.
„ „ <i>fastigiata</i>	—	18	—	—	10	S.	„
<i>Thuopsis borealis</i>	—	28	2	6	15	W.	„
<i>Wellingtonia gigantea</i> ...	—	45	7	0	21	S.W.	„

GENERAL REMARKS.—The above specimens are among the largest of their kind growing in the grounds here, and they, as well as many others of the hardy Coniferae, are very healthy and thriving. There are other specimens of those in the list fully equal in beauty, and exceeding them in girth of stem and spread of branches: an *Abies Pinsapo*, for instance, girths 4 feet, with a diameter of branches of 25 feet—a very handsome specimen. There are also many other fine specimens of Cedars and Yews, which are a special feature of the place. *Cupressus macrocarpa* a few years planted grows very fast, and is doing remarkably well.

KILKENNY.

WOODSTOCK. LADY LOUISA TIGHE.

Altitude, 400 feet. Soil, light loam; subsoil, sandy.

Correspondent: Mr. WILLIAM GRAY, The Gardens, Woodstock, Inistiege.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies cephalonica</i>	—	61	8 6	48	N.E.	Very ornamental.
„ <i>Douglasii</i>	—	50	4 9	34	„	Fine specimen.
„ <i>Menziesii</i>	42	62	8 0	40	„	„ „
„ <i>Morinda</i>	42	57	4 6	24	„	Very ornamental.
„ <i>nobilis</i>	—	30	4 0	26	„	Fine; but loses leader.
„ <i>Nordmanniana</i> ...	40	49	4 10	27	„	Handsome tree.
<i>Araucaria imbricata</i> ...	59	54	8 4	31	„	Grand specimen.
<i>Cedrus atlantica</i>	30	40	4 2	26	open.	Fine; very much exposed.
„ <i>Deodara</i>	46	52	4 9	23	N.E.	Splendid specimen.
„ <i>Libani</i>	66	78	9 0	46	„	„ „
<i>Cryptomeria japonica</i> ...	—	48	6 2	28	„	„ „
„ <i>Lobbi</i>	—	52	5 0	21	„	„ „
<i>Cupressus Lawsoniana</i>	28	34	—	18	„	Fine; fast growing.
<i>Pinus austriaca</i>	—	45	5 6	28	„	Fine specimen.
„ <i>excelsa</i>	—	48	4 6	24	„	„ „
„ <i>insignis</i>	—	78	10 9	42	„	Most ornamental of Pines.
„ <i>Lambertiana</i> ...	—	50	4 0	24	„	Very fine specimen.
„ <i>monticola</i>	—	45	4 8	28	„	„ „
„ <i>Pinaster</i>	—	60	7 9	34	„	„ „
<i>Taxodium sempervirens</i>	—	68	10 4	36	„	A handsome tree.
<i>Thuja gigantea</i>	—	60	7 9	34	„	„ „ quick grower.
<i>Thuyopsis borealis</i>	—	50	—	27	„	A perfect pyramid.
<i>Wellingtonia gigantea</i>	27	60	6 4	29	„	Very fine specimen.

GENERAL REMARKS.—The newer Conifers were planted here in considerable numbers soon after they were introduced or became popular, and many of them have reached a good size and form beautiful specimens. Those given in the table are among the most ornamental trees of their kind here, although they may not always be the very largest. The exact ages of many of them are not recorded, and are omitted in the table. Most of the coniferous family that are hardy in Britain thrive well in our light sandy loam, on an open sandy, or red sandstone, subsoil, of a very poor quality. Some species make remarkably well-furnished and very ornamental trees, particularly *Abies cephalonica*, *A. Morinda*, *Araucaria imbricata*, the Cedars, *Cryptomerias*, *Cypresses*, *Pinus insignis*, *Taxodium sempervirens*, *Thuyopsis borealis*, *Wellingtonia gigantea*, and some others. In looking through some old records to find the ages of the Conifers, I came across the following note about *Abies Douglasii*, which may be of interest: “An *Abies Douglasii*, planted in 1839, was cut down in 1870, being too near the fine specimen of *A. cephalonica*. It measured 62 feet in height, with a girth of 9 feet 4 inches at the butt, and 5 feet 10 inches at 4 feet from the ground”—a large bulk of timber for a growth of 31 years. A few years ago, we cut down a good-sized tree of *Taxodium sempervirens* (Redwood), and used the timber for cabinet work. The wood was found to be smooth, of a beautiful colour and grain, and took on a fine polish.

KING'S COUNTY.

BIRR CASTLE. EARL ROSSE.

Altitude, low. Soil, heavy loam; subsoil, clay.

Correspondent: Mr. T. J. HART, The Castle Gardens, Parsonstown.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies grandis</i>	—	65	6 0	29	sheltd.	Splendid tree.
„ <i>nobilis</i>	—	83	6 0	32	„	„ „
<i>Araucaria imbricata</i> ...	—	30	2 6	14	„	Thriving well.
<i>Cupressus Lawsoniana</i>	—	40	4 6	30	„	„ „
<i>Taxodium sempervirens</i>	—	35	3 0	25	„	„ „
<i>Wellingtonia gigantea</i>	—	45	9 0	30	„	A fine specimen.

GENERAL REMARKS.—There are but few large specimens of the newer Conifers growing here, but those of which the details are given above are fine thriving trees. A goodly number of young trees, of these and other species, have been planted within the last 15 years, most of which are in a fine healthy and vigorous condition; although the soil is of a very heavy nature, resting on a stiff clayey subsoil.

LIMERICK.

ADARE MANOR. EARL OF DUNRAVEN.

Altitude, 60 feet. Soil, loam; subsoil, limestone.

Correspondent: Mr. ALFRED BARKER, The Gardens, Adare.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Morinda</i>	40	32	—	22	N.E.	Thriving; graceful tree.
„ <i>pectinata</i>	80	90	7 6	—	„	Many huge specimens.
<i>Araucaria imbricata</i> ...	28	26	2 6	15	„	Fine thriving specimens.
<i>Cedrus Deodara</i>	50	46	5 6	25	„	„
„ <i>Libani</i>	10	38	10 0	60	„	Several fine specimens.
<i>Cryptomeria japonica</i> ...	—	45	3 2	15	„	Doing fairly well.
<i>Cupressus Lawsoniana</i>	32	43	4 3	30	„	Several as fine specimens.
„ <i>macrocarpa</i> ...	—	55	—	58	„	Many fine vigorous trees.
<i>Pinus excelsa</i>	48	50	7 2	44	„	Thrives vigorously.
„ <i>insignis</i>	50	72	7 6	27	„	„
<i>Taxodium sempervirens</i>	—	30	5 0	36	„	Thrving; gales brkleader.
<i>Thuya gigantea</i>	—	27	5 10	12	„	„
<i>Wellingtonia gigantea</i>	—	55	6 7	22	„	Thrives remarkably well.

GENERAL REMARKS.—Most Conifers that will grow in a strongly calcareous soil, on a limestone or gravelly subsoil, seem to do well here. The following species grow very freely, and are the most remarkable for the dimensions they

have attained: *Cedrus Deodara*, grows very freely wherever planted; *Cedrus Libani*, many of which are probably 100 or more years old, and immense wide-spreading trees; *Cupressus macrocarpa*, a most rampant grower, of which there are many fine specimens; *C. Lawsoniana*, *C. L. erecta viridis*, *C. nuthainensis*, free growing and very handsome; *Pinus excelsa*, and *Pinus insignis*, strong growing vigorous trees; *P. Pinaster*, and *P. sylvestris*, many fine specimens of both; *Sequoia gigantea*, and *S. sempervirens*, many specimens as fine as those noted; several Junipers, particularly *J. recurva*; and many others of lesser note. The worst foe with which Conifers have to contend in this locality is the strong south-westerly gales which so frequently blow with great force, and are very liable to injure the leading shoots while they are sappy and growing.

QUEEN'S COUNTY.

ABBEE LEIX. VISCOUNT DE VESCI.

Altitude, 300 feet. Soil, yellow loam; subsoil, sand.

Correspondent: Mr. ALEXANDER BARNETT, The Gardens, Abbee Leix.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies concolor</i>	36	45	6 10	55	Shldt.	Fine specimen.
„ <i>Douglasii</i>	25	60	5 5	38	„	„ „
„ <i>magnifica</i>	30	40	4 4	23	„	„ „
„ <i>Menziesii</i>	55	65	8 9	60	„	„ „
„ <i>nobilis</i>	20	35	3 2	18	„	„ „
„ <i>Nordmanniana</i> ...	40	50	7 6	18	„	„ „
<i>Araucaria imbricata</i> ...	18	18	1 7	11	„	Vigorous young tree.
<i>Cedrus Deodara</i>	25	30	4 7	30	„	Fine specimen.
<i>Pinus Cembra</i>	25	30	2 2	8	„	„ „
„ <i>excelsa</i>	30	40	4 6	29	„	„ „
<i>Taxodium sempervirens</i>	20	40	5 5	24	„	„ „
<i>Thuyopsis borealis</i>	30	40	3 3	24	„	„ „
<i>Wellingtonia gigantea</i>	25	45	6 0	23	„	„ „

GENERAL REMARKS.—The details of some of the finest Conifers growing here are given in the table. They are all thriving and making fine specimens, especially where they have room and are well sheltered.

ROSCOMMON.

ROCKINGHAM. Miss KING HARMAN.

Altitude, 180 feet. Soil, strong loam; subsoil, clay.

Correspondent: Mr. JAMES CLEWS, The Gardens, Rockingham, Boyle.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	12	16	1 9	10	Shltd.	Doing well; fine tree.
„ <i>Douglasii</i>	22	39	3 2	22	Expsd.	Doing splendid; very fine.
„ <i>Menziesii</i>	20	34	4 6	22	Shltd.	Thrives very well.
„ <i>Nordmanniana</i> ...	12	16	1 2	10	„	„ „
<i>Cedrus Deodara</i>	45	45	7 0	40	„	Beautiful tree.
<i>Cupressus Lawsoniana</i>	18	22	—	16	„	Doing very well.
<i>Pinus austriaca</i>	20	30	2 0	16	„	„ „
„ <i>excelsa</i>	20	26	2 4	22	„	„ „
„ <i>Laricio</i>	22	34	2 9	17	Expsd.	„ „
<i>Taxus baccata fastigiata</i>	45	30	—	15	Shltd.	Very fine specimen.
<i>Thuja gigantea</i>	22	36	4 6	25	Expsd.	Thrives well; fast grower.
<i>Thuyopsis borealis</i>	22	26	3 0	15	„	Very beautiful tree.
<i>Wellingtonia gigantea</i>	22	42	6 2	25	„	Handsome specimen.

GENERAL REMARKS.—Nearly all the newer Conifers at Rockingham have been planted by me within the last 22 years, and those I planted soon after coming here in 1869 are growing splendidly, especially *Abies Douglasii*, which was planted freely in the woods, where it is thriving remarkably well, and will, I think, become a valuable timber tree. *Thuja gigantea*, and *Abies Menziesii*, a handsome Spruce, are also growing very freely; and so is *Pinus Laricio*. *Abies Albertiana* and *A. Nordmanniana* are very promising, but the latter requires shelter, while the former is one of the hardiest of Conifers. *Cedrus Deodara* and *Thuyopsis borealis* are among the most beautiful of Conifers; and *Cupressus Lawsoniana*, with its variety *C. L. erecta viridis*, is among the most useful of ornamental trees.

SLIGO.

MARKREE CASTLE. Colonel E. H. COOPER.

Altitude, 130 feet. Soil, heavy loam and peat; subsoil, marl and limestone.

Correspondent: Mr. FREDERICK BOTTOMER, Steward, Markree, Collooney.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	27	80	5 2	33	S.	Very fine specimen.
„ <i>Menziesii</i>	27	75	4 10	30	N.E.	„ „
„ <i>Nordmanniana</i> ...	27	50	2 10	18	„	„ „
<i>Cedrus atlantica</i>	36	40	2 8	19	„	Healthy; good specimen.
<i>Cupressus Lawsoniana</i>	20	24	—	23	„	Very fine; several stems.
<i>Taxodium sempervirens</i>	27	45	4 0	25	„	Very fine specimen.
<i>Thuja gigantea</i>	23	40	—	32	S.	„ „
<i>Thuyopsis borealis</i>	27	32	2 7	23	„	„ „
<i>Wellingtonia gigantea</i> ..	30	55	4 5	16	E.	„ „

GENERAL REMARKS.—In the very heavy and retentive soil which chiefly predominates on this domain, comparatively few of the coniferous family continue to thrive for any great length of time, although many of them promise well for a few years after they are planted. As will be seen, however, from the measurements given, *Abies Douglasii*, *A. Menziesii*, and *A. Nordmanniana* are thriving remarkably well. These, as well as the *Taxodium sempervirens* and *Thuyopsis borealis*, were planted by me in February 1867, and the progress they have made in the time is very satisfactory. The same may be said in respect to *Cupressus Lawsoniana* and *Thuja gigantea*—two quick-growing, hardy, and useful Conifers. The *Wellingtonia gigantea* of which details are given is the only really good specimen among many, and generally they are not doing at all well. Most kinds of the newer Conifers have been planted here from time to time, but, except those mentioned, they have all proved more or less unsatisfactory. I may add, the Scots Pine and Silver Fir, as well as Ash, Beech, and other hardwood trees, grow remarkably well in the strong soil and moist climate of this district.

TIPPERARY.

SHANBALLY CASTLE. VISCOUNT LISMORE.

Soil, heavy and light loam; subsoil, stiff clay and gravel.

Correspondent: Mr. JOHN FRASER, The Gardens, Shanbally, Clogheen.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Douglasii</i>	30	67	5 6	38	N.E.	Very healthy tree.
„ <i>nobilis</i>	27	44	4 6	24	N.	Thriving well.
<i>Cedrus Deodara</i>	27	51	4 0	24	N.W.	Very fine specimen.
<i>Wellingtonia gigantea</i> ..	34	70	8 6	30	„	„ „

GENERAL REMARKS.—The majority of the newer Conifers at Shanbally Castle are not in a particularly thriving state, owing probably to the excess of lime in the strong retentive soil. The above *Abies Douglasii* and *A. nobilis* are notable exceptions, and are very fine trees of their age. The specimens of the *Wellingtonia gigantea* and *Cedrus Deodara*, of which the dimensions are given, are growing in a glen at the foot of the Galtee Mountains, where they are thriving remarkably well, in a deep red sandy soil, on a gravel subsoil, in which Rhododendrons are also doing extra well.

TYRONE.

BARON'S COURT. DUKE OF ABERCORN.

Altitude, 200 to 300 feet. Soil, deep peat, and loam; subsoil, gravel.

Correspondent: Mr. ROBERT BELL, Steward, &c., Baron's Court, Newtown Stewart.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	32	48	3 0	22	Sheldt.	Growing 2½ ft. above lake
„ <i>Douglasii</i>	25	52	4 0	30	„	Very vigorous grower.
„ <i>grandis</i>	25	48	2 10	18	„	Growing close to lake.
„ <i>magnifica</i>	12	15	0 9	5	„	Healthy and handsome.
„ <i>Menziesii</i>	25	45	2 8	36	„	Very vigorous grower.
„ <i>nobilis</i>	20	42	2 10	16	„	Very vigorous and healthy
„ <i>Nordmanniana</i> ...	25	35	2 0	15	„	Vigorous grower.
<i>Araucaria imbricata</i> ...	—	35	3 10	20	„	Healthy; fine specimen.
<i>Cedrus atlantica</i>	30	48	4 1	27	„	„ „
„ <i>Deodara</i>	40	50	5 7	36	„	„ „
<i>Cupressus Lawsoniana</i>	22	22	1 10	12	„	Healthy and free growing
„ „ <i>erecta viridis</i>	25	18	1 7	7	„	Beautiful erect trees.
„ „ <i>lutea</i>	16	8	0 8	6	„	Very richly coloured.
<i>Pinus austriaca</i>	25	32	3 5	14	S.W.	Bad grower.
„ <i>Cembra</i>	25	40	2 8	12	Sheldt.	Unhealthy.
„ <i>insignis</i>	8	14	0 9	7	„	Very healthy and vigorous
„ <i>Laricio</i>	35	50	5 0	20	„	Fine tree; branchy.
<i>Taxodium sempervirens</i>	25	38	3 6	23	„	Fine; rapid grower.
<i>Thuja gigantea</i>	25	40	2 8	17	„	„ „
<i>Thuyopsis borealis</i>	20	20	1 5	12	„	Very graceful trees.
<i>Wellingtonia gigantea</i>	25	54	6 2	21	„	Beautiful healthy trees.

GENERAL REMARKS.—The newer Conifers, with very few exceptions, thrive well here and make a vigorous growth. Many of them are fine specimens of their kinds, as they are growing in well-sheltered spots surrounded by hardwoods, from which the Conifers are now being kept clear. *Abies Douglasii*, *A. Menziesii*, *A. nobilis*, *Thuja gigantea*, and the *Wellingtonia* are the most rapid growers, and form, where they have had room to spread, very handsome and well-furnished trees. All the Cypressess thrive vigorously, and *Cupressus Lawsoniana erecta viridis* and *C. L. lutea* grow very freely, and being planted in quantity in the gardens, their elegant forms and rich colours produce a very pleasing effect, and are quite a feature of the place.

WATERFORD.

CURRAGHMORE. MARQUIS OF WATERFORD.

Altitude, 250 to 300 feet. Soil, light loam; subsoil, sandy.

Correspondent: Mr. EDWARD TUCKER, The Gardens, Curraghmore, Portlaw.

Botanical Name	Age	Height	Girth at 5ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies cephalonica</i>	40	36	3 6	18	Sheld.	Healthy, fine tree.
" <i>concolor</i>	17	30	2 0	15	S.	Fast growing; beautiful.
" <i>Douglasii</i>	25	36	3 0	25	"	Vigorous growing.
" <i>Engelmanni</i>	17	24	2 1	14	"	Beautiful tree.
" <i>grandis</i>	56	68	8 0	—	"	A very fine tree.
" <i>Menziesii</i>	56	110	10 0	50	"	A grand specimen.
" <i>Morinda</i>	40	60	6 6	36	"	Very graceful.
" <i>nobilis</i>	40	65	7 3	37	"	Fine specimen.
" <i>Nordmanniana</i> ..	25	20	2 0	10	"	Fine slow-growing tree.
" <i>pectinata</i>	120	100	11 0	55	"	A splendid specimen.
<i>Araucaria imbricata</i> ...	45	45	4 3	30	"	A well-furnishd specimen.
<i>Cedrus atlantica</i>	45	35	3 0	18	"	Healthy; growing slow.
" <i>Deodara</i>	40	36	3 6	30	"	A perfect specimen.
<i>Cryptomeria elegans</i> ...	25	12	—	15	"	Distinct and effective.
" <i>japonica</i> ...	30	35	4 0	25	"	Fine specimen.
<i>Cupressus Goveniana</i> ...	30	16	—	14	"	Fine small tree.
" <i>Lawsoniana</i> ...	30	35	3 2	20	"	A very useful tree.
" <i>erecta viridis</i>	25	28	3 0	8	"	A very effective variety.
" <i>macrocarpa</i>	30	57	4 3	30	"	Fine fast-growing tree.
<i>Juniperus recurva</i>	30	15	2 0	10	"	Graceful habit.
" <i>sinensis</i>	30	21	—	11	"	Fine small tree.
<i>Libocedrus decurrens</i>	30	20	3 0	10	"	Distinct in habit & colour.
<i>Pinus austriaca</i>	50	45	7 4	40	"	Coarse spreading tree.
" <i>Cembra</i>	120	35	5 2	38	"	Fine old specimen.
" <i>excelsa</i>	50	30	6 10	37	"	Top often broken by wind.
" <i>insignis</i>	50	38	4 6	35	"	Loses top occasionally.
" <i>Jeffreyi</i>	35	30	3 0	25	S.W.	Exposed to high winds.
" <i>Laricio</i>	30	35	2 6	25	"	" "
" <i>ponderosa</i>	17	20	1 8	10	"	" "
" <i>sylvestris</i>	120	90	6 6	—	S.	In sheltered valley.
<i>Thuya gigantea</i>	20	22	2 0	21	"	A beautiful tree.
" <i>Wareana</i>	20	12	3 0	10	"	" "
<i>Thuyopsis borealis</i>	20	20	2 0	20	"	" "
<i>Wellingtonia gigantea</i>	20	30	3 6	15	"	A fine specimen.

GENERAL REMARKS.—The newer Conifers have been planted here in considerable numbers, and are mostly growing in a well-sheltered valley surrounded by deciduous trees. They are generally in a thriving condition, and some of the older trees are very fine specimens; notably *Abies Menziesii*, *A. grandis*, *A. nobilis*, and *A. Morinda*, the Silver Fir, and the Scots Fir. The last is growing on the banks of a river, in good free soil, where there are many thousands of Scots Fir nearly equal to it, and in fine healthy condition. The *Araucaria*, *Deodara*, *Cryptomeria*, *Cypresses*, *Junipers*, and *Arborvitae*, all thrive well, and make beautiful specimens. Most of the Pines grow at the highest altitudes—*Pinus Laricio* at 500 feet—and are much exposed to high wind, which often breaks off their leading shoots.

WESTMEATH.

WATERSTOWN. Hon. T. HARRIS TEMPLE.

Altitude, 200 feet. Soil, light loam, peaty, deep bog; subsoil, gravel.

Correspondent: Mr. ROBERT ANDERSON, The Gardens, Waterstown, Athlone.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	20	27	2 1	17	open	Healthy; fine specimen.
„ <i>canadensis</i>	—	23	—	22	„	Grows well in wet bog.
„ <i>Douglasii</i>	30	60	4 9	38	„	Vigorous specimen.
„ <i>grandis</i>	24	35	2 6	22	„	Healthy; fine tree.
„ <i>Menziesii</i>	—	56	7 4	51	„	Very fine specimen.
„ <i>Nordmanniana</i> ...	30	28	2 5	19	„	„ „
„ <i>Pinsapo</i>	30	28	5 2	31	„	„ „
<i>Cedrus Deodara</i>	48	64	6 0	31	sheltd.	„ „
<i>Cupressus Lawsoniana</i>	30	33	4 7	23	„	„ „
„ <i>macrocarpa</i>	—	43	4 8	45	W.	„ „
<i>Pinus excelsa</i>	—	50	6 0	41	sheltd.	„ „
„ <i>insignis</i>	—	62	7 3	40	„	„ „
<i>Taxodium sempervirens</i>	30	41	3 9	20	„	„ „
<i>Thuopsis borealis</i>	30	26	—	31	„	Very ornamental.
<i>Wellingtonia gigantea</i>	30	37	4 9	22	open	Handsome specimen.

GENERAL REMARKS.—Most of the hardy kinds of Conifers grow well here, and particularly the species named in the above list. On bog land very few species are at all satisfactory; but the Hemlock Spruce takes kindly to it, and *Pinus excelsa* is thriving fairly well on the drier parts. *Abies Douglasii* grows with great vigour on the warm loam, on a gravelly subsoil, where also *A. grandis*, *A. Menziesii*, *Cupressus Lawsoniana*, *C. macrocarpa*, and *Pinus insignis* thrive remarkably well.

WEXFORD.

COURTOWN. EARL OF COURTOWN.

Altitude, 20 to 40 feet. Soil, alluvial and loam; subsoil, clay, gravel, and rocky

Correspondent: Mr. JAMES TURNER, The Gardens, Courtown, Gorey.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies alba</i>	22	15	0 9	10	Level.	Fine ornamental tree.
" <i>Albertiana</i>	19	46	3 6	21	"	Vigorous specimen.
" <i>Douglasii</i>	41	60	9 6	62	E.	" "
" <i>Menziesii</i>	22	25	2 6	15	Level.	Growth checkd. by storms
" <i>Nordmanniana</i> ...	16	26	1 6	12	"	Very ornamental.
" <i>Smithiana</i>	41	49	6 0	25	"	Graceful habit; fine tree.
" <i>Webbiana</i>	41	52	6 3	40	E.	Fine specimen.
<i>Araucaria imbricata</i>	41	35	4 0	17	Level.	" "
<i>Cedrus Deodara</i>	46	45	6 0	30	"	" "
<i>Cryptomeria japonica</i> ...	27	41	4 6	22	S.	Very handsome.
<i>Cupressus Lawsoniana</i> ...	22	29	3 0	15	S.W.	Valuable for ornament.
" <i>erecta</i>	22	25	2 0	5	"	" "
" <i>viridis</i>	19	19	—	6	"	" "
" <i>macrocarpa</i> ...	24	42	5 0	30	In a hollow.	Vigorous specimen.
" <i>nutkaënsis</i> ...	27	21	2 3	15	Level.	Very graceful habit.
<i>Pinus excelsa</i>	46	42	5 3	30	S.	Fine specimen.
" <i>insignis</i>	24	40	3 2	15	W.	Vigorous & free-growing.
" <i>Laricio</i>	41	49	5 6	30	Level.	Fine specimen.
<i>Sequoia sempervirens</i> ...	27	47	5 6	30	"	Fast grower; leader brittle
<i>Thuja gigantea</i>	23	36	5 0	16	"	Vigorous; useful tree.
<i>Thuyopsis dolabrata</i>	24	20	1 6	10	"	Beautiful and useful.

GENERAL REMARKS. By the Earl of Courtown.—The ages of the specimens of Conifers of which the details are given are counted from the year in which the trees were planted. They are growing at a low altitude, near to the sea, on the Wexford coast, where the low sand-hills along the shore afford very little shelter from the saline breeze. *Pinus insignis*, planted in much exposed places, stands the saline blast remarkably well. Among the most flourishing of our other Conifers are *Abies Douglasii*, some hundreds of which, of different ages, are growing vigorously; *A. Albertiana*, very fast grower and handsome tree; *Cupressus macrocarpa*, a most vigorous grower and one of the best for resisting the salt blast from the sea; *Cryptomeria japonica*, very flourishing and handsome; *Cupressus Lawsoniana*, which promises to be useful for timber, as well as its several varieties, all hardy and very ornamental; and *Thuja gigantea*, of which large numbers have been raised from cuttings of the oldest tree (the dimensions of which are given in the table), and planted out in the domain, where they are growing vigorously and promise in time to be valuable timber trees. For ornament, besides the *Cupressus* mentioned, *Cupressus nutkaënsis*, formerly known as *Thuyopsis borealis*, is a very valuable Conifer; and so is the handsome and very distinct *Thuyopsis dolabrata*, which grows well here. *Sequoia sempervirens* grows fast, but the leader is so brittle that it is very liable to be broken with the gale, and in consequence it is not likely to prove a useful timber-tree in this locality. *Abies Menziesii* has also suffered from the storms, although not to the same extent. *Abies alba* is a fine ornamental Spruce, and might be useful in damp localities and at high altitudes.

WICKLOW.

COOLLATTIN. EARL FITZWILLIAM.

Altitude, 600 feet. Soil, light gravelly loam ; subsoil, slaty rock.

Correspondent : Mr. JAMES WHYTOCK, The Gardens, Coollattin Park, Shillelagh.

Botanical Name	Age	Height	Girth at 5 ft. up	Diameter of branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies canadensis</i>	45	30	7 0	28	E.	Very good specimen.
„ <i>concolor</i>	25	46	4 3	17	„	„ „
„ <i>Douglasii</i>	40	74	10 0	45	S.E.	Vigorous; handsome tree.
„ <i>grandis</i>	16	25	2 0	16	W.	„ „
„ <i>Menziesii</i>	45	80	9 0	38	N.E.	„ „
„ <i>nobilis</i>	25	40	4 0	15	„	Free growing; fine.
„ <i>Nordmanniana</i> ...	16	22	1 6	11	E.	Handsome, vigorous tree.
„ <i>Pinsapo</i>	30	40	4 9	28	N.	Fine specimen.
„ <i>Smithiana</i>	30	50	4 0	20	„	„ „
<i>Araucaria imbricata</i> ...	35	30	5 0	28	N.E.	„ „
<i>Cedrus Deodara</i>	35	46	10 6	38	W.	Very fine specimen.
<i>Cryptomeria japonica</i> ...	38	67	5 0	28	S.W.	„ „
<i>Cupressus Lawsoniana</i>	25	35	4 6	17	„	„ „
„ <i>macrocarpa</i>	40	64	9 3	51	„	„ „
<i>Pinus Cembra</i>	30	25	4 0	15	N.E.	Good specimen.
„ <i>excelsa</i>	40	44	16 0	44	S.W.	Fine spreading tree.
„ <i>insignis</i>	40	56	9 0	52	„	„ „
<i>Taxodium sempervirens</i>	40	55	8 6	29	E.	Very fine specimen.
<i>Wellingtonia gigantea</i>	34	64	8 6	25	S.E.	„ „

GENERAL REMARKS.—The introduced Conifers were freely planted at Coollattin soon after their introduction to this country, and many of them are now large and very fine specimens. *Abies Douglasii*, *A. grandis*, and *A. Menziesii* are by far the fastest growers, and average over 2 feet of growth in height of leader every year. *A. nobilis*, *A. Nordmanniana*, and *A. Smithiana* also grow tolerably fast, but require more shelter. *Cryptomeria japonica*, *Cupressus Lawsoniana*, *C. macrocarpa*, *Pinus insignis*, and *Wellingtonia gigantea*, thrive well, and form fine trees.

POWERSCOURT. VISCOUNT POWERSCOURT.

Altitude, 300 to 450 feet. Soil, loam, peaty; subsoil, gravel and sand.

Correspondent: Mr. DAVID CROMBIE, The Gardens, Powerscourt, Enniskerry.

Botanical Name	Age	Height	Girth at 5ft. up	Diameter of Branches	Exposure	Remarks
	Years	Feet	Ft. In.	Feet		
<i>Abies Albertiana</i>	24	46	4 2	21	S.W.	Healthy; fine trees.
" <i>canadensis</i>	22	35	3 0	12	S.	" "
" <i>concolor</i>	24	40	4 2	30	S.E.	Very fine specimen.
" <i>Douglasii</i>	32	75	7 0	32	"	" "
" <i>grandis</i>	24	32	4 2	16	S.W.	Beautiful, healthy tree.
" <i>lasiocarpa</i> ..	22	32	6 0	16	S.	" "
" <i>magnifica</i>	24	35	4 0	10	S.E.	" "
" <i>Menziesii</i>	25	48	4 8	22	S.	Healthy and fine.
" <i>Morinda</i>	25	40	5 0	22	S.W.	" "
" <i>nobilis</i>	25	43	3 4	18	S.E.	" "
" <i>Nordmanniana</i> ...	25	45	5 0	20	S.	Very fine specimen.
" <i>orientalis</i>	22	22	3 0	12	"	" "
" <i>Pindrow</i>	24	43	4 0	20	"	Fine healthy tree.
" <i>Pinsapo</i>	24	45	5 0	24	"	Very fine specimen.
" <i>Webbiana</i>	24	48	4 2	24	S.W.	" "
<i>Araucaria imbricata</i> ...	25	25	2 6	16	"	Healthy and fine.
<i>Cedrus atlantica</i>	25	40	3 4	25	"	" "
" <i>Deodara</i>	25	45	3 6	25	S.	Weakly specimen.
<i>Cryptomeria japonica</i> ...	32	48	7 6	30	S.E.	Very fine specimen.
<i>Cupressus Lawsoniana</i>	25	40	3 10	24	S.W.	" "
" <i>macrocarpa</i>	32	63	7 6	38	S.	" "
<i>Fitzroya patagonica</i> ...	22	18	1 6	12	S.E.	Healthy and fine.
<i>Pinus austriaca</i>	25	38	4 2	18	S.W.	" "
" <i>Cembra</i>	25	35	3 9	18	S.	" "
" <i>excelsa</i>	24	40	3 6	25	S.E.	" "
" <i>insignis</i>	32	82	10 0	33	"	Very fine specimen.
" <i>Jeffreyi</i>	25	40	2 3	14	N.E.	Healthy and fine.
" <i>ponderosa</i> ..	24	36	2 0	14	"	" "
<i>Taxodium sempervirens</i>	25	50	5 6	20	S.	Fine specimen.
<i>Thuya gigantea</i>	24	57	5 0	24	S.W.	Very fine specimen.
" <i>occidentalis pendula</i>	22	15	2 0	8	S.	Fine ornamental tree.
<i>Thuyopsis borealis</i>	24	40	4 0	22	S.E.	Beautiful tree.
<i>Wellingtonia gigantea</i>	30	52	9 10	24	S.	Very fine healthy spec.

GENERAL REMARKS.—The newer Conifers were planted here in great numbers from 20 to 30 years ago, both in the ornamental grounds and in the plantations, and generally speaking they have made satisfactory progress. Among them all, probably the Douglas Fir takes the lead as a free-growing, handsome, and useful tree. It is nothing unusual for it, as well as several others of the newer Coniferae, to make a leading shoot of 3 feet in a season, and some of them approach 4 feet. The free soil and airy slopes of the Wicklow mountains, on which they grow, seem to suit the great majority of Conifers, and in such a position many of them promise to form very handsome trees, with fine, straight, well-grown stems, at a

comparatively early period. After the Douglas Fir, *Pinus insignis* is noticeable for its vigorous growth; and nearly all the *Abies* tribe follow closely on their heels; even *A. Webbiana* grows vigorously, although it is considered a rather delicate species in this country. The *Araucaria*, Cedar, *Cryptomeria*, Cypress, Juniper, *Retinospora*, and *Thuya*, all grow luxuriantly, and many fine specimens of the best species and varieties of them are thriving well, and forming very beautiful trees and shrubs. *Cupressus Lawsoniana*, and its many fine varieties, are among the hardest and most useful of ornamental Conifers; *C. macrocarpa* is very fast growing and ornamental; and *C. nutkaënsis* (*Thuyopsis borealis*) is one of the most graceful and beautiful of all the Conifers. The Patagonian Cypress also does well, and forms a nice small tree. Among the Pines, none approach *P. insignis* in quick growth; but many of them are doing well, and are really fine ornamental specimens. *Sequoia* (*Taxodium*) *sempervirens* makes splendid growth in a peaty soil, and well sheltered. *Thuya gigantea* grows with great freedom, and is a most promising tree. Of the *Wellingtonia gigantea*, a large number of specimens have been planted, and are growing in perfect health and making very fine and attractive specimens. In general, the Conifers are a great feature in the landscape, and have a very pleasing and effective appearance.

THE UNITED KINGDOM.

IV.—LIST OF CONIFERS AND LARGEST SPECIMENS.

A TABLE, giving a LIST of all the CONIFERS NAMED in the foregoing TABLES; with the PLACE and COUNTY where the LARGEST SPECIMENS grow; their greatest recorded HEIGHT, and GIRTH of STEM at 5 ft. up; and the NUMBER of RETURNS in which they appear. Total number of returns, 102. Where a species is twice mentioned, the second tree has the thickest stem.

Botanical Name	Place	County	Height		Girth		No. of Returns
			Ft.	In.	Ft.	In.	
<i>Abies ajanensis</i> ...	Ochertyre	Perthshire ...	24	0	1	8	2
" alba	Courtown	Wexford	15	6	0	9	1
" Albertiana...	Castle Menzies	Perth	72	0	5	9	56
" "	The Cairnies ...	"	63	0	6	9	—
" Alcockiana	Castle Kennedy	Wigtown ...	32	0	1	9	3
" amabilis? ...	Drumlanrig ...	Dumfries ...	32	0	3	0	5
" balsamea ...	Saltoun	East Lothian	68	0	9	0	2
" brachyphylla	Castlewellan ...	Down	14	0	—	—	1
" bracteata ...	Boconnoc	Cornwall.....	49	6	4	6	6
" canadensis...	Studley Royal	York	60	0	10	0	7
" cephalonica .	Powderham ...	Devon	77	0	*11	2	26
" cilicica	Rossdhu	Dumbarton...	10	0	0	6	1
" concolor.....	Linton Park ...	Kent	64	0	8	7	42
" Douglasii ...	Dropmore	Bucks	120	0	11	0	84
" "	Lynedoch	Perth	91	9	12	0	—
" " Stairii	Ochertyre	"	20	0	1	4	2
" Engelmanni.	Curraghmore ...	Waterford ...	24	0	2	1	2
" excelsa	Lynedoch	Perth	106	3	10	0	2
" firma	Carclew	Cornwall.....	45	0	*2	8	1
" Fraserii	Powderham ...	Devon	72	0	*9	7	2
" grandis	Riccarton	Midlothian...	83	3	3	8½	56
" "	Poltalloch	Argyll	64	0	7	9	—
" Hookeriana	Murthly	Perth	30	0	4	0	8
" magnifica ...	The Cairnies ...	"	50	0	3	6	38
" "	Revesby	Lincoln	40	0	5	0	—
" Menziesii ...	Curraghmore ...	Waterford ...	110	0	10	0	56
" "	Boconnoc	Cornwall.....	85	0	12	0	—
" Morinda	Carclew	"	80	0	*7	7	28
" "	Hopetoun	West Lothian	76	0	8	0	—
" nigra	Mount Stuart...	Bute	46	0	3	5	2
" nobilis	Birr Castle.....	King's	83	0	6	0	76
" "	Coul.....	Ross	77	6	7	10	—
" Nordmanniana	Poltalloch	Argyll	70	0	6	0	78
" "	Killarney	Kerry	50	0	10	6	—
" numidica ...	Pampisford.....	Cambridge ...	20	0	1	0	2
" orientalis ...	Penrhyn	Carnarvon ...	58	0	—	—	13
" "	Glamis	Forfar	38	0	4	6	—

* Girth at 3 feet up.

LIST OF CONIFERS AND LARGEST SPECIMENS—*continued*.

Botanical Name	Place	County	Height		Girth		No. of Returns
			Ft.	In.	Ft.	In.	
<i>Abies Pattoniana</i>	Murthly	Perth	35	0	3	10	4
" <i>pectinata</i> ...	Carton	Kildare	111	0	15	6	9
" " ...	Rossdhu	Dumbarton...	110	0	17	9	—
" <i>Pindrow</i>	Powerscourt ...	Wicklow	43	0	4	0	5
" <i>Pinsapo</i>	Pampisford	Cambridge ...	62	0	9	0	24
" <i>polita</i>	Kinnettles	Forfar	15	0	1	6	3
" <i>religiosa</i> ...	Pota	Cork	60	0	3	6	2
" <i>Veitchiana</i> ..	Ragley	Warwick	24	6	1	10	3
" <i>Webbiana</i> ...	Courtown	Wexford	52	0	6	3	12
" " ...	Howick Hall ...	Northumber- land	51	0	8	0	—
<i>Araucaria imbricata</i>	Dropmore	Bucks	68	0	8	0	74
" "	Woodstock	Kilkenny ...	54	0	8	4	—
" "	Menabilly	Cornwall	14	0	—	—	2
<i>Athrotaxis laxifolia</i>	Golden Grove...	Carmarthen	10	0	—	—	1
" <i>selaginoides</i>	Castlewellan ...	Down	14	0	—	—	1
<i>Biota orientalis aurea</i>	Dalkeith	Midlothian...	6	0	—	—	3
<i>Cedrus atlantica</i> ...	Mulgrave	York	68	0	5	10	45
" " ...	Brahan	Ross	48	0	9	0	—
" <i>Deodara</i> ...	Studley Royal	York	70	0	7	6	68
" " ...	Coollattin	Wicklow	46	0	10	6	—
" <i>Libani</i> ...	Methven	Perth	90	0	9	10	14
" " ...	Bretby	Derby	82	0	16	2	—
<i>Cephalotaxus drupacea</i>	Powderham ...	Devon	8	0	—	—	1
<i>Cryptomeria elegans</i>	Poltalloch	Argyll	24	0	1	0	6
" <i>japonica</i> ...	Coollattin	Wicklow	67	0	5	0	28
" "	Keir	Perth	42	6	9	8	—
<i>Cupressus Goveniana</i>	Curraghmore...	Waterford ...	16	0	—	—	1
" <i>Lawsoniana</i>	Dupplin	Perth	55	0	4	3	72
" "	Torloisk	Argyll	34	0	8	6	—
" <i>erecta viridis</i>	Curraghmore ...	Waterford ...	28	0	3	0	8
" <i>gracilis aurea</i>	Garbally	Galway	15	0	—	—	2
" <i>lutea</i>	Castlewellan ...	Down	11	0	—	—	3
" <i>pendula</i> ...	Hewell	Worcester ...	40	0	2	0	1
" <i>lusitanica</i> ...	Rossdhu	Dumbarton...	30	0	2	9	1
" <i>macrocarpa</i>	Carclew	Cornwall	82	0	*10	7	26
" "	Coollattin	Wicklow ...	64	0	9	3	—
" <i>sempervirens</i>	Keir	Perth	40	0	1	9	2
" <i>thyoides</i>	Murthly	"	45	0	2	9	3
" <i>torulosa</i>	Dalkeith	Midlothian ...	11	6	1	2	2
<i>Dacrydium Franklinii</i>	Castlewellan ...	Down	8	6	—	—	1
<i>Fitzroya patagonica</i>	Powerscourt ...	Wicklow	18	0	1	6	3
<i>Juniperus chinensis</i>	Murthly	Perth	27	0	1	4	4
" <i>excelsa</i> ...	Carton	Kildare ...	17	0	1	0	2
" <i>recurva</i> ...	Keir	Perth	30	0	—	—	4
" <i>virginiana</i>	Studley Royal	York	70	0	6	0	2
<i>Larix europæa</i>	Rossdhu	Dumbarton...	100	0	10	0	6
" "	Hewell	Worcester ...	80	0	11	0	—
" <i>Kæmpferi</i> ...	Carclew	Cornwall	30	0	3	7	4

* Girth at 3 feet up.

LIST OF CONIFERS AND LARGEST SPECIMENS—*continued*.

Botanical Name	Place	County	Height		Girth		No. of Returns
			Ft.	In.	Ft.	In.	
<i>Libocedrus chilensis</i>	Castlewellan ...	Down	12	0	1	2	2
" <i>decurrens</i>	Orton	Huntingdon	50	0	—	—	12
" "	Torloisk	Argyll	37	0	6	3	—
<i>Pinus austriaca</i> ...	Linton Park ...	Kent	74	0	8	0	42
" "	Shane's Castle	Antrim	55	0	11	9	—
" <i>Banksiana</i> ...	Pampisford	Cambridge ...	26	0	1	2	1
" <i>Bolanderii</i> ...	Ochertyre	Perth	19	0	1	1	1
" <i>Cembra</i>	Linton Park ...	Kent	68	6	5	0	52
" "	Howick	N'thumberld.	45	0	9	0	—
" <i>excelsa</i>	Studley Royal	York	70	0	6	0	40
" "	Coollattin	Wicklow	44	0	16	0	—
" <i>Hartwegii</i> ...	Mount Stuart ...	Bute	33	0	1	10	2
" <i>insignis</i>	Dromore	Bucks	90	0	11	0	33
" "	Boconnoc	Cornwall	68	0	13	0	—
" <i>Jeffreyi</i>	Fordell	Fife	50	0	3	6	18
" "	Revesby	Lincoln	48	0	6	8	—
" <i>koraiensis</i> ...	Ochertyre	Perth	13	0	1	3	1
" <i>Lambertiana</i>	Revesby	Lincoln	50	0	6	8	5
" "	Poltalloch	Argyll	45	0	9	0	—
" <i>Laricio</i>	Boconnoc	Cornwall	79	0	5	9	34
" "	Riccarton	Midlothian ...	69	3	7	7½	—
" <i>macrocarpa</i>	Linton Park ...	Kent	44	0	4	6	4
" <i>montana</i> ...	Drumlanrig ...	Dumfries ...	24	0	2	10	3
" <i>Montezumæ</i>	Menabilly	Cornwall	16	0	—	—	2
" <i>monticola</i> ...	Scone	Perth	71	6	5	11	26
" <i>occarpa</i>	Menabilly	Cornwall	21	0	—	—	1
" <i>Pallasiana</i> ...	Brodie	Moray	50	0	7	7	4
" <i>parviflora</i> ...	Menabilly	Cornwall	8	0	—	—	1
" <i>patula</i>	Carclew	"	45	0	*6	0	1
" <i>Pinaster</i>	Hewell	Worcester ...	68	0	10	0	3
" <i>Pinea</i>	"	"	30	0	4	0	1
" <i>ponderosa</i> ...	Linton Park ...	Kent	63	0	9	2	24
" <i>pyrenaica</i> ...	Keir	Perth	35	0	5	4	3
" <i>Sabiniana</i> ...	Pampisford ...	Cambridge ...	24	0	2	6	1
" <i>Strobis</i>	Logie, Scone ...	Perth	90	0	7	6	8
" "	Murthly	"	50	0	7	8	—
" <i>sylvestris</i> ...	Studley Royal	York	90	0	11	3	7
<i>Podocarpus andinus</i>	Castlewellan ...	Down	10	6	—	—	2
<i>Prumnopitys elegans</i>	Tortworth	Gloucester ...	17	0	—	—	3
" "	Poltalloch	Argyll	13	0	1	10	—
<i>Retinospora filifera</i>	Castlewellan ...	Down	12	0	—	—	2
" <i>leptoclada</i>	Menabilly	Cornwall	4	0	—	—	1
" <i>obtusa</i>	Carclew	"	23	0	*2	7	4
" <i>pisifera</i>	Rossdhu	Dumbarton	18	0	2	0	1
" <i>plumosa</i>	"	"	15	0	1	8	3
<i>Salisburia adiantifolia</i>	Dalkeith	Midlothian ...	48	6	4	2	2
<i>Saxegothea conspicua</i>	Ochertyre	Perth	10	0	—	—	2

* Girth at 3 feet up.

LIST OF CONIFERS AND LARGEST SPECIMENS—*continued.*

Botanical Name	Place	County	Height	Girth	No. of Returns
			Ft. In.	Ft. In.	
Sciadopitys verticillata	Castlewellan ...	Down	10 0	—	4
Sequoia sempervirens	Boconnoc	Cornwall.....	75 0	13 0	52
„ „ variegata	Pampisford ...	Cambridge...	16 0	1 10	1
Taxodium distichum	Rossdhu	Dumbarton...	30 0	3 5	3
„ „	Revesby	Lincoln	27 0	3 8	—
„ „ pendulum	Hewell	Worcester ...	50 0	6 0	1
Taxus adpressa ...	Dalkeith.....	Midlothian...	10 0	—	2
„ baccata	Rossdhu	Dumbarton...	40 0	13 0	3
„ „ aurea ...	Dalkeith.....	Midlothian...	8 0	—	3
„ „ Dovastonii	„	„	6 0	—	1
„ „ fastigiata	Rockingham ...	Roscommon	30 0	—	3
Thuya gigantea ...	Linton Park ...	Kent	65 0	6 0	58
„ „	Woodstock.....	Kilkenny ...	60 0	7 9	—
„ occidentalis pendula	Powerscourt ...	Wicklow	15 6	2 0	1
„ „ Vervæneana	Castlewellan ...	Down	12 0	—	1
„ „ Wareana	Curraghmore ...	Waterford ...	12 6	3 0	1
„ „ Standishii	Dalkeith	Midlothian...	15 0	1 0	3
Thuyopsis borealis	Murthly	Perth	50 0	1 9	56
„ „	Brahan	Ross.....	45 0	2 8	—
„ „ variegata	Pampisford.....	Cambridge...	22 0	1 0	2
„ dolabrata	Boconnoc	Cornwall.....	25 0	2 0	8
„ „ variegata	Carclew	„	17 0	—	2
Torreya myristica	Tortworth	Gloucester ...	21 0	2 10	1
Wellingtonia gigantea	Shanbally.....	Tipperary ...	80 0	8 6	86
„ „	Castle Menzies	Perth	52 0	13 9	—
„ „ pendula	Dalkeith.....	Midlothian...	13 0	1 0	2
„ „ variegata	Castlewellan ...	Down	18 0	—	4
„ „ „	Durris.....	Kincardine...	14 6	1 6	—

SUNDRY STATISTICS.

At the time of the Conference a paper asking for statistics and for a consensus of opinion on various points was issued by the Society independently of—indeed in ignorance of—the paper issued by Mr. Malcolm Dunn. A large number of returns were sent in. Some of the statistics, where they traverse the same ground gone over by Mr. Dunn's returns (*see* p. 481), are not repeated here; but the following tables drawn up from the consensus of opinion as to Conifers suited for particular uses will be found of much value to planters.

In the following tables the names adopted are those of Dr. Masters' synopsis (*see* p. 188), and they are placed in the order of merit which results from a tabulation of all the returns.

TABLE I.

CONIFERS MOST SUITABLE FOR PARK TREES.

Varieties receiving less than 5 votes are omitted.

Order of Merit	Name	No. of Votes	Order of Merit	Name	No. of Votes
1	<i>Abies nobilis</i>	28	20	<i>Abies pectinata</i>	10
2	<i>Pseudotsuga Douglasii</i>	26	21	„ <i>cephalonica</i>	9
3	<i>Abies Nordmanniana</i>	23	21	„ <i>magnifica</i>	9
3	<i>Sequoia gigantea</i>	23	21	<i>Picea sitchensis</i>	9
5	<i>Cedrus Libani</i>	22	21	<i>Pinus insignis</i>	9
6	<i>Abies grandis</i>	21	21	„ <i>silvestris</i>	9
7	<i>Pinus Laricio nigricans</i>	19	26	<i>Abies concolor</i>	8
7	<i>Thuja gigantea</i>	19	26	<i>Larix europæa</i>	8
9	<i>Cedrus atlantica</i>	18	26	<i>Picea excelsa</i>	8
10	<i>Pinus Strobus</i>	17	26	<i>Pinus monticola</i>	8
11	<i>Cupressus Lawsoniana</i>	16	26	„ <i>ponderosa</i>	8
11	<i>Tsuga Mertensiana</i>	16	26	<i>Sequoia sempervirens</i>	8
13	<i>Pinus Cembra</i>	15	32	<i>Abies Pinsapo</i>	7
13	„ <i>Laricio</i>	15	32	<i>Picea Alcockiana</i>	7
15	<i>Cedrus Deodara</i>	14	34	<i>Cupressus nootkatensis</i>	6
16	<i>Araucaria imbricata</i>	12	34	<i>Picea orientalis</i>	6
16	<i>Cupressus macrocarpa</i>	12	36	<i>Abies lasiocarpa</i>	5
18	<i>Pinus excelsa</i>	11	36	„ <i>Lowiana</i>	5
18	<i>Picea Morinda</i>	11	36	<i>Cryptomeria japonica</i>	5

TABLE II.
CONIFERS MOST SUITABLE FOR LARGE GARDENS AND PLEASURE GROUNDS.
Varieties receiving less than 5 votes are omitted.

Order of Merit	Name	No. of Votes	Order of Merit	Name	No. of Votes
1	Cupressus Lawsoniana	32	22	Pinus Cembra	9
2	Thuya gigantea	22	22	Abies Lowiana	9
3	Araucaria imbricata	21	26	" cephalonica	8
4	Cupressus nootkatensis	19	26	" amabilis	8
5	Abies nobilis	17	26	Picea Morinda	8
5	Cryptomeria japonica elegans	17	26	Thuya occidentalis	8
5	Tsuga Mertensiana	17	30	Picea pungens glauca	7
8	Cryptomeria japonica	16	30	Pinus excelsa	7
8	Abies Nordmanniana	16	30	" insignis	7
8	" Pinsapo	16	30	Tsuga canadensis	7
8	Cedrus Deodara	16	30	Abies magnifica	7
12	Tsuga Pattoniana	15	35	" Webbiana	6
13	Thuya dolabrata	14	35	Cupressus pisifera plumosa	6
14	Libocedrus decurrens	13	35	Juniperus virginiana	6
14	Picea orientalis	13	35	Picea Alcockiana	6
14	Pseudotsuga Douglasii	13	35	" sitchensis	6
14	Sequoia gigantea	13	40	Cupressus obtusa	5
14	" sempervirens	13	40	Juniperus chinensis	5
19	Cedrus Libani	12	40	Picea Engelmannii	5
19	Abies grandis	12	40	Pinus Laricio	5
21	Cupressus macrocarpa	10	40	" silvestris	5
22	Abies concolor	9	40	Sciadopitys verticillata	5
22	Cedrus atlantica	9	40	Cedrus atlantica glauca	5

TABLE III.
CONIFERS SUITABLE FOR SMALLER GARDENS.
Varieties receiving less than 4 votes are omitted.

1	Cupressus Lawsoniana	22	13	Abies nobilis	5
2	Cryptomeria japonica elegans	16	13	Araucaria imbricata	5
3	Thuya dolabrata	14	13	Cupressus obtusa	5
4	Juniperus chinensis	13	13	Juniperus recurva	5
5	Cupressus nootkatensis	9	13	Picea excelsa	5
6	Sciadopitys verticillata	8	13	Thuya occidentalis	5
6	Taxus baccata	8	13	Tsuga Pattoniana	5
8	Libocedrus decurrens	7	20	Abies Nordmanniana	4
9	Abies Pinsapo	6	20	Cupressus pisifera	4
9	Cedrus Deodara	6	20	Taxus baccata adpressa	4
9	Picea orientalis	6	20	Thuya orientalis	4
9	Thuya gigantea	6	20	Tsuga canadensis	4

TABLE IV.
CONIFERS SUITABLE FOR ROCK GARDENS.
Varieties receiving less than 3 votes are omitted.

1	Picea excelsa Clanbrassilliana	14	11	Cupressus Thyoides	4
2	Juniperus Sabina	10	11	Juniperus japonica	4
3	Cupressus Lawsoniana nana	9	11	" squamata	4
4	Thuya dolabrata	7	11	Picea excelsa pygmaea	4
5	Cupressus obtusa nana	6	16	Cryptomeria japonica elegans	
5	Thuya orientalis aurea	6		nana	3
7	Cupressus pisifera	5	16	Cryptomeria japonica nana	3
7	Juniperus communis	5	16	Juniperus recurva	3
7	Picea excelsa pumila	5	16	" Sabina variegata	3
7	Taxus baccata	5	16	Pinus montana	3
11	Cupressus nootkatensis	4			

TABLE V.

CONIFERS SUITABLE FOR WIND-BREAKS.

Varieties receiving less than 4 votes are omitted.

Order of Merit	Name	No. of Votes	Order of Merit	Name	No. of Votes
1	<i>Pinus Laricio nigricans</i>	24	9	<i>Abies pectinata</i>	6
2	" <i>silvestris</i>	17	9	<i>Larix europæa</i>	6
3	" <i>Laricio</i>	16	9	<i>Pinus Pinaster</i>	6
4	<i>Cupressus Lawsoniana</i>	11	12	<i>Pinus Cembra</i>	5
5	<i>Picea excelsa</i>	10	12	<i>Thuja occidentalis</i>	5
6	<i>Thuja gigantea</i>	9	14	<i>Abies Nordmanniana</i>	4
7	<i>Pseudotsuga Douglasii</i>	8	14	<i>Cupressus nootkatensis</i>	4
7	<i>Taxus baccata</i>	8	14	<i>Tsuga canadensis</i>	4

TABLE VI.

CONIFERS SUITABLE FOR EXPOSED POSITIONS NEAR THE SEA.

Varieties receiving less than 3 votes are omitted.

1	<i>Pinus Laricio nigricans</i>	16	6	<i>Pinus Pinaster</i>	6
2	<i>Cupressus macrocarpa</i>	10	7	<i>Sequoia sempervirens</i>	4
3	<i>Pinus Laricio</i>	9	8	<i>Abies Nordmanniana</i>	3
3	" <i>silvestris</i>	9	8	<i>Abies pectinata</i>	3
5	" <i>insignis</i>	8			

TABLE VII.

THE BEST VARIEGATED AND COLOURED-FOLIAGED CONIFERS.

Varieties receiving less than 4 votes are omitted.

1	<i>Cupressus Lawsoniana lutea</i>	16	10	<i>Thuja orientalis aurea</i>	7
2	" <i>pisifera plumosa</i>		12	" <i>dolabrata variegata</i>	6
	<i>aurea</i>	15	12	<i>Taxus baccata fastigiata</i>	
3	<i>Taxus baccata aurea</i>	13		<i>aurea</i>	6
4	<i>Cupressus obtusa aurea</i>	11	14	<i>Cupressus Lawsoniana albo-variegata</i>	5
4	<i>Juniperus chinensis aurea</i>	11	14	<i>Cupressus Lawsoniana aurea variegata</i>	5
6	<i>Taxus baccata elegantissima</i>	10	16	<i>Pseudotsuga Douglasii Stairii</i>	4
7	<i>Cryptomeria japonica elegans</i>	8	16	<i>Thuja occidentalis aurea</i>	4
7	<i>Cupressus pisifera aurea</i>	8	16	<i>Abies nobilis glauca</i>	4
7	<i>Thuja orientalis elegantissima</i>	8			
10	<i>Picea pungens glauca</i>	7			

TABLE VIII.

CONIFERS MOST SUITABLE FOR TIMBER TREES IN WOODS AND FORESTS.

Varieties receiving less than 5 votes are omitted.

1	<i>Pseudotsuga Douglasii</i>	35	12	<i>Cupressus Lawsoniana</i>	8
2	<i>Pinus Laricio</i>	19	12	<i>Pinus Strobus</i>	8
3	<i>Abies grandis</i>	18	12	<i>Tsuga Mertensiana</i>	8
4	<i>Thuja gigantea</i>	17	15	<i>Abies pectinata</i>	7
5	<i>Picea sitchensis</i>	15	16	<i>Picea excelsa</i>	6
6	<i>Abies nobilis</i>	14	17	<i>Cedrus atlantica</i>	5
6	" <i>Nordmanniana</i>	14	17	<i>Cupressus macrocarpa</i>	5
8	<i>Pinus silvestris</i>	11	17	<i>Pinus Cembra</i>	5
9	<i>Larix europæa</i>	10	17	" <i>insignis</i>	5
10	<i>Pinus Laricio nigricans</i>	9	17	" <i>monticola</i>	5
10	<i>Sequoia sempervirens</i>	9			

LIST OF EXHIBITORS, AND AWARDS RECOMMENDED BY THE JUDGES.

Awards Recommended:—

FOR GROUPS AND COLLECTIONS OF CUT SPECIMENS.

Silver Gilt Flora Medal.

To Sir Patrick Keith Murray, Bart., Ochtertyre, Crieff, Perthshire (gardener, Mr. George Croucher).

Silver Gilt Knightian Medal.

To the Right Hon. the Earl of Mansfield, Scone Palace, Perth (forester, Mr. Lewis Bayne; gardener, Mr. Alexander McKinnon).

To the Right Hon. the Earl of Stair, Castle Kennedy, Stranraer, Wigtownshire (forester, Mr. James Hogarth).

Silver Knightian Medal.

To the Director, Botanic Gardens, Edinburgh.

To F. W. Cornwallis, Esq., Linton Park, Maidstone (gardener, Mr. John McKenzie).

To W. H. Maxwell, Esq., Munches, Dalbeattie, N.B.

To Mrs. Ford, Pencarrow, Bcdmin, Cornwall (gardener, Mr. Henry Jones).

To Messrs. Dicksons, Chester.

Silver Gilt Banksian Medal.

To Messrs. J. Veitch & Sons, King's Road, Chelsea.

To Mr. A. Waterer, Knap Hill, Woking.

Silver Banksian Medal.

To Her Most Gracious Majesty the Queen, Balmoral, Ballater, Aberdeenshire (forester, Mr. John Michie).

To the Right Hon. the Earl of Aberdeen, Haddo House, Aberdeen (forester, Mr. John Clark).

To the Right Hon. the Earl of Devon, Powderham Castle, Exeter (gardener, Mr. D. C. Powell).

To T. Acton, Esq., J.P., D.L., Kilmacurragh, Rathdrum, co. Wicklow.

To W. Steuart Fotheringham, Esq., Murthly Castle, Perth (gardener, Mr. James Laurie).

To A. Stirling, Esq., Keir, Dunblane, Perthshire (gardener, Mr. Thomas Lunt).

To Messrs. C. Lee & Son, Royal Vineyard Nursery, Hammer-smith.

To Messrs. Paul & Son, Cheshunt.

Bronze Banksian Medal.

To His Grace the Duke of Buccleuch, Dalkeith Palace, N.B. (gardener, Mr. Malcolm Dunn).

To the Right Hon. the Earl of Hopetoun, Hopetoun, Linlithgow (gardener, Mr. James Smith).

To Sir R. Menzies, Bart., Castle Menzies, Perthshire.

To A. H. Smith-Barry, Esq., Fota Island, co. Cork (gardener, Mr. W. Osborne).

To R. S. Holford, Esq., Westonbirt, Tetbury, Gloucester (forester, Mr. Rattray).

To Mrs. Malcolm Patton, The Cairnies, Perth (forester, Mr. John McLaggan).

To Mrs. Williams, Scorrier, Cornwall (gardener, Mr. H. Hutchinson).

To Messrs. Jefferies & Son, Cirencester.

To Messrs. W. Barron & Son, Elvaston, Borrowash, Derby.

To Messrs. W. Cutbush & Son, Highgate.

Other Exhibits.

Besides the above, collections of Conifers were contributed by the following:—

His Grace the Duke of Sutherland, Dunrobin Castle, N.B. (gardener, Mr. David Melville).

His Grace the Duke of Argyll, Inverary Castle, Argyll (gardener, Mr. George Taylor).

His Grace the Duke of Buccleuch, Drumlanrig, N.B. (forester, Mr. John Fingland).

His Grace the Duke of Devonshire, Chatsworth, Derbyshire.
The Right Hon. the Earl of Cromarty, Castle Leod, Ross-shire.

The Right Hon. Lord Poltimore, Poltimore, Exeter.

The Right Hon. Lord Kinnaird, Rossie Priory, Perth (gardener, Mr. John McKiddie).

The Countess of Seafield, Cullen House, Banff (forester, Mr. C. Y. Michie).

Lady Fortescue, Dropmore, Bucks (gardener, Mr. Charles Herrin).

Sir James H. Gibson Craig, Bart., Riccarton, Midlothian.

Sir R. Jardine, Bart., Castlemilk, Dumfriesshire (gardener, Mr. William King).

Sir T. D. Acland, Bart., Killerton, Exeter.

Sir Simon Macdonald Lockhart, Bart., Lee Castle, Lanark, N.B. (gardener, Mr. T. Galbraith).

Sir J. Colquhoun, Bart., Rosdhu, Dumbartonshire (gardener, Mr. Finlay McPherson).

The Hon. H. H. Duncan, Fordell, Fifeshire (gardener, Mr. George Ramsay).

Colonel Hammond, Pampisford Hall, Cambridge.

J. Ord Mackenzie, Esq., Dolphinton, Peeblesshire.

Colonel Balfour, Balfour Castle, Kirkwall, Orkney (gardener, Mr. Thomas McDonald).

W. H. Nicholson, Esq., J.P., Basing Park, Alton (gardener, Mr. W. Smythe).

R. G. Lake, Esq., Trevarrick, St. Austell, Cornwall.

C. J. Lucas, Esq., Warnham Court, Horsham, Sussex.

W. Gunn, Esq., Nutwood, Strathpeffer, N.B.

J. Rashleigh, Esq., Menabilly, Cornwall (gardener, Mr. William Bennett).

W. Barrow, Esq., Hollowmead Lodge, Bishops-Teignton, Devon (gardener, Mr. J. Willis).

Messrs. Little & Ballantyne, Carlisle.

Messrs. Fisher, Son, & Sibray, Handsworth, Sheffield.

The Director of the Royal Gardens, Kew, sent a collection of specimens, photographs, and drawings of Conifers.

Dr. Maxwell T. Masters, F.R.S., contributed specimens of cones of rare species, a splendid collection of photos and

engravings from the *Gardeners' Chronicle*, and many works treating specially on Conifers.

Mrs. Robb, 46 Rutland Gate, sent original paintings by Chinese artists, a drawing of the Maidenhair Tree (*Ginkgo biloba*) attracting much attention.

Some very fine photographs of cones and branches of Danish Conifers were sent by Professor Carl Hansen, 6, Svanholmsvei, Copenhagen.

Photographs of great size and excellence were also contributed by W. Steuart Fotheringham, Esq., Murthly Castle, Perth.

Conifer literature was sent by W. H. Blandford, Esq., 8 Wimpole Street.

Messrs. J. Veitch & Sons, Chelsea, exhibited their valuable "Manual of Coniferæ."

Prizes :—

Conifers, Collection of Fresh Cones and Branches with Foliage. Amateurs.

First Prize, Veitch Memorial Medal and £5, to the Dowager Marchioness of Huntly (gardener, Mr. A. Harding).

Second Prize, Silver Knightian Medal and £2. 10s., to Right Hon. Lord Wimborne, Canford Manor, Wimborne (gardener, Mr. T. H. Crasp).

AGATHIS
australis (*Dumbara*)

ARAUCARIA
Cunninghamii
imbricata

ATHROTAXIS
cupressoides
Gunniana
laxifolia

BIOTA
aurea = *Thuya orientalis* var.
elegantissima = *Thuya orientalis* var.
japonica filiformis = *Thuya occidentalis* var.
orientalis = *Thuya orientalis*
sempervirens = *Thuya orientalis* var.

CALLITRIS
australis (*Frenela*)
cupressoides = *Widdringtonia cupressoides*
rhomboidea (*Frenela*)

CEDRUS
atlantica
" glauca
Deodara
" aurea
Libani

CEPHALOTAXUS
drupacea
Fortunei
pedunculata compacta
" fastigiata (*Podocarpus Koraiana*)

CHAMÆCYPARIS
glauca = *Widdringtonia glauca*
sphaeroidea = *Cupressus thyoides*

CRYPTOMERIA
elegans = *C. japonica* var.
" *nana* = *C. japonica* var.
japonica
" albo-spica
" compacta
" elegans
" " nana
" Lobbii
" spiralis

CUNNINGHAMIA
sinensis

CUPRESSUS
arizonica
Benthamii
Corneyana = *C. torulosa* var.
Goveniana
Lawsoniana
" alba
" " maculata
" albo-spica

CUPRESSUS
Lawsoniana albo-variegata
" Alumi
" argenteo-variegata
" aureo-variegata
" compacta
" erecta
" " Fraserii
" " glauca
" " viridis
" " " aureo-variegata
" " " variegata
" ericoides
" filiformis (*C. L. filifera*,
C. L. fil. gracilis, and
C. L. filiformis elegans)
" glauca
" gracilis (*C. L. gracilis pendula*)
" *gracillima* = *C. L. gracilis*
" intertexta
" juniperina
" lutea
" lutescens
" nana
" " albo-maculata
" " compacta gracilis
" " glauca
" Milford Blue Jacket
" minima glauca
" monumentalis glauca
" pendula
" plumosa
" pulcherrima
" pygmaea
" " viridis
" pyramidalis
" " alba
" " albo-spica
" " argentea
" Shawii
" Silver Queen
" Smithii
" stricta
" variegata
" versicolor
" Youngii
" Waitzii
" Westermannii

Insitanica
macrocarpa
" Crippsii
" variegata
nootkatensis (*Thuyopsis borealis*)
" albo-variegata
" argentea
" aureo-variegata

CUPRESSUS

- nootkatensis compacta (*Thuyopsis borealis* var.)
 „ lutea (*Thuyop. borealis* var.)
 „ nana „ „
 „ variegata
 nuthaensis = C. nootkatensis
 obtusa (*Retinospora*)
 „ aurea (*Retinospora*)
 pisifera (*Retinospora*)
 „ nana (*Retinospora*)
 sempervirens
 thyoides (*Chamaecyparis sphaeroidea*)
 „ aurea (*Chamaecyparis*)
 torulosa Corneyana (*Juniperus pendula*)

DACRYDIUM

- cupressinum
 elatum
 Franklinii

DAMMARA

- australis = Agathis

FITZROYA

- Archerii (*Diselma*)
 patagonica

FRENELA

- australis = Callitris australis
 rhomboidea = „ rhomboidea

GINKGO

- biloba (*Salisburia adiantifolia*)

JUNIPERUS

- Bermudiana
 canadensis aurea = J. communis var.
 chinensis
 „ alba (*J. japonica alba*)
 „ albo-variegata (*J. japonica albo-variegata*)
 „ albo-variegata foemina
 „ argentea
 „ aurea (*J. japonica aurea*)
 „ aureo-variegata (*J. jap. aureo-variegata*)
 „ foemina (*J. Reevesiana*)
 „ japonica (*J. japonica*)
 „ procumbens (*J. procumbens*)
 „ variegata
 communis aureo-variegata
 „ canadensis aurea
 „ hibernica (*J. hibernica*)
 „ „ compressa
 compressa = J. com. hibernica var.
 drupacea
 excelsa reflexa
 hibernica = J. communis var.
 japonica = J. chinensis var.
 macrocarpa (*J. neoboracensis*)
 neoboracensis = J. macrocarpa

JUNIPERUS

- pendula = Cupressus torulosa Corneyana
 procera = J. excelsa var.
 procumbens = J. chinensis var. (*fide* Beissner)
 prostrata = J. Sabina
 recurva
 „ densa
 „ squamata (*J. squamata*)
 Revesiana = J. chinensis foemina (*fide* Beissner)
 Sabina
 „ albo-variegata
 „ tamariscifolia (*J. tamariscifolia*)
 Schottii = J. virginiana var.
 sinensis = J. chinensis
 squamata = J. recurva var.
 tamariscifolia = J. Sabina var.
 virginiana
 „ albo-spica
 „ aureo-variegata
 „ compacta
 „ elegans
 „ elegantissima
 „ glauca
 „ plumosa alba
 „ „ argentea
 „ Schottii (*J. Schottii*)
 „ Triomphe d'Angers

LARIX

- Kampferii = Pseudolarix Kampferii
 leptolepis

LIBOCEDRUS

- chilensis
 decurrens (*Thuja Craigiana*)
 Doniana (*Thuja*)
 tetragona

MICROCACHRYS

- tetragona

PHYLLOCLADUS

- asplenifolius

PICEA

- ajanensis (*Abies*)
 alba (*Abies*)
 „ glauca
 „ nana fastigiata
 Alcockiana (*Abies acicularis*)
 brachyphylla = *Abies brachyphylla*
 bifida = *Abies firma* var.
 bifolia = „ lasiocarpa
 canadensis pendula = *Tsuga canadensis* var.
 Caroliniana = *Tsuga Caroliniana*
 concolor = *Abies concolor*
 „ violacea = *Abies concolor* var.
 Douglasii glauca pendula = *Pseudotsuga Douglasii* var.

PICEA

- Engelmannii
 " glauca (*Abies*)
 excelsa
 " aurea (*Abies*)
 " Clanbrassiliana (*Abies*)
 " Dumettii (*Abies*)
 " dumosa (*Abies*)
 " finedonensis (*Abies*)
 " Gregoryana (*Abies*)
 " Maxwellii (*Abies*)
 " monstrosa (*Abies*)
 " nana (*Abies*)
 " pendula
 " pygmæa (*Abies*)
 " Remontii (*Abies*)
 " viminalis erecta
Fraserii = *Abies Fraserii*
grandis = " *grandis*
lasiocarpa = " *lasiocarpa*
Lowiana = " *Lowiana*
Menziesii = *P. sitchensis*
Morinda (*Abies Smithiana*, *A. Khutrow*)
nigra (*Abies*)
 " *Mariana*
 " *nana* (*Abies*)
nobilis = *Abies*
 " *glauca* = *Abies nobilis* var.
Nordmanniana = *Abies*
numidica = *Abies*
Omorica (*Abies*)
orientalis (*Abies*)
 " *aurea* (*Abies*)
 " *polita* (*Abies*)
 " *pygmæa* (*Abies*)
Parsonsiana = *Abies Lowiana*
Pichta = *Abies sibirica*
Pindrow = " *Webbiana* var.
Pinsapo = *Abies*
polita (*Abies polita*)
pungens (*Abies Parryana*, *A. pungens*)
 " *argentea* (*Abies*)
 " *glauca* (*Abies Parryana* var.)
religiosa = *Abies*
sitchensis (*Abies Menziesii*, *A. sitchensis*)
sub-alpina = *Abies lasiocarpa*
Veitchii = *Abies*
Webbiana = *Abies*

PINUS

- aristata* = *P. Balfouriana*
austriaca = *P. Laricio nigricans*
Ayacuahuite
Balfouriana (*P. aristata*)
Benthamiana = *P. ponderosa*
Bolanderii = *P. contorta*
Cembra
 " *helvetica*

PINUS

- contorta* (*P. Bolanderii*)
densiflora
excelsa
flexilis
inops
insignis
Jeffreyi
koraiensis
Laricio
 " *aurea*
 " *nigricans* (*P. austriaca*)
montana (*P. Pumilio*)
Montezumæ
monticola
muricata
palustris
parviflora
Parryana
patula
Peuce
Pinea
ponderosa (*P. Benthamiana*)
Pumilio = *P. montana*
pyrenaica
rigida
Russelliana = *P. Montezumæ*
silvestris
 " *argentea*
 " *globosa* *nana*
 " *pumila*
 " *pygmæa*
 " *pyramidalis*
Strobus
 " *nana*
 PODOCARPUS
alpina
andina
coriacea = *Torreya nucifera*
elongata
Koraiana = *Cephalotaxus pedunculata*
 " *fastigiata*
nubigena
 PRUMNOPITYS
elegans
 PSEUDOLARIX
Kämpferii (*Larix Kämpferii*)
 PSEUDOTSUGA
Donglasii (*Abies*)
 " *glauca* (*Abies*)
 " *pendula* (*Picea*)
 RETINOSPORA
ericoides = *Thuya occidentalis* var. and
 " *Cupressus thuyoides* var.
flicoides = *Cupressus obtusa* var.
filifera = " " "
 " *aurea* = " " "
 " *elegans* = " " "

RETINOSPORA

<i>filifera gracilis</i>	=	Cupressus obtusa
<i>leptoclada</i>	=	" thyoides var.
<i>lycopodioides</i>	=	" obtusa var.
<i>magnifica</i>	=	(?)
<i>obtus</i>	=	" "
" <i>alba</i>	=	" " var.
" <i>albo-spica</i>	=	" " "
" <i>aurea</i>	=	" " aurea
" <i>compacta</i>	=	" " var.
" <i>filifera-</i> <i>argentea</i>	=	" " var.
" <i>flavescens</i>	=	" " "
" <i>gracilis</i>	=	" " "
" <i>gracilis</i>	=	" " "
" <i>aurea</i>	=	" " "
" <i>nana aurea</i>	=	" " "
" <i>com-</i> <i>pacta</i>	=	" " "
" <i>gracilis</i>	=	" " "
" <i>pyramid-</i> <i>alis</i>	=	" " "
<i>pisifera</i>	=	" pisifera
" <i>aurea</i>	=	" " "
" <i>nana aurea</i>	=	" " "
" <i>aurea</i> <i>variegata</i>	=	" " "
" <i>sulphurea</i>	=	" " "
<i>plumosa</i>	=	" " "
" <i>alba varie-</i> <i>gata</i>	=	" " "
" <i>albo-picta</i>	=	" " "
" <i>argentea</i>	=	" " "
" <i>aurea</i>	=	" " "
<i>pygmæa</i>	=	(?)
<i>squarrosa</i>	=	" " "
" <i>sulphurea</i>	=	" " "
<i>tetragona aurea</i>	=	" obtusa "

SALISBURIA

adiantifolia = Ginkgo biloba

SAXEGETHEA

conspicua

SCIADOPITYS

verticillata

SEQUOIA

gigantea (Wellingtonia)

" *erecta*

" *pendula*

sempervirens (Taxodium)

" *albo-spica*

TAXODIUM

distichum

" *pendulum*

sempervirens = Sequoia sempervirens

albo-spica = " " var.

TAXUS

<i>baccata</i>	
" <i>adpressa stricta</i>	
" " <i>variegata</i>	
" <i>aurea</i>	
" " <i>variegata</i>	
" <i>argentea variegata</i>	
" <i>Dovastonii</i>	
" " <i>aurea</i>	
" " <i>variegata</i>	
" <i>elegantissima</i>	
" " <i>nova</i>	
" <i>erecta aurea variegata</i>	
" <i>fastigiata</i>	
" " <i>aurea</i>	
" " " <i>variegata</i>	
" " <i>grandis</i>	
" " <i>lutea</i>	
" " <i>variegata</i>	
" <i>fœmina</i>	
" <i>glauca</i>	
" <i>gracilis pendula</i>	
" <i>hibernica aurea variegata</i>	
" <i>horizontalis aurea</i>	
<i>Barronii</i>	
<i>canadensis</i> (T. Washingtonii)	
<i>Dovastonii</i> = T. <i>baccata</i> var.	
<i>elegantissima</i> = " "	
<i>grandis</i> = " <i>fastigiata</i> var.	
<i>Washingtonii</i> = T. <i>canadensis</i>	

THUYA

<i>Craigiana</i> = Libocedrus decurrens	
<i>dolabrata</i> (Thuyopsis)	
" <i>laetevirens</i> (Thuyopsis)	
" <i>robusta</i> (Thuyopsis)	
" <i>variegata</i> (Thuyopsis)	
<i>Doniana</i> = Libocedrus	
<i>Ellwangeriana</i> = T. <i>occidentalis</i> var.	
<i>gigantea</i> (T. <i>Lobbii</i> , T. <i>Menziesii</i>)	
" <i>aurea variegata</i>	
" <i>gracilis</i>	
" <i>semper-aurea</i> (T. <i>Lobbii</i> var.)	
<i>japonica pygmæa</i>	
" <i>Standishii</i> (Thuyopsis)	
<i>Lobbii</i> = T. <i>gigantea</i>	
<i>Menziesii</i> = T. <i>gigantea</i>	
<i>minima glauca</i> = T. <i>plicata</i> <i>pygmæa</i> <i>glauca</i>	

occidentalis

" <i>albo-spica</i>	
" <i>argentea</i>	
" <i>aurea</i>	
" <i>Boothii</i>	
" <i>Ellwangeriana</i>	
" <i>globosa</i>	
" <i>japonica filiformis</i> (Biota)	
" <i>lutea</i>	
" <i>nana compacta</i>	

THUYA

- occidentalis pendula
 „ recurva nana
 „ variegata
 „ Vervaniana
 „ Wareana
 orientalis
 „ argenteo-variegata (*Biota*)
 „ aurea (*Biota aurea*)
 „ elegantissima (*Biota*)
 „ „ picta (*Biota*)
 „ lutea
 „ minima (*Biota*)
 „ semperaurescens (*Biota*)
 plicata lutea
 „ minima
 „ „ pygmæa glauca
semperaurescens = *T. orientalis* var.
Standishii = *T. japonica*
Vervaniana = *T. occidentalis* var.
Wareana = „ „ „

THUYOPSIS

- berealis* = *Cupressus nootkatensis*
dolabrata = *Thuya dolabrata*

THUYOPSIS

Standishii = *Thuya japonica* var.

TORREYA

- drupacea* = *Cephalotaxus drupacea*
Myristica
nucifera (*Podocarpus coriacea*)

TSUGA

- canadensis* (*Abies*)
 „ *albo-spica* (*Abies*)
 „ *dumosa* (*Abies Brunonian*)
 „ *gracilis* (*Abies*)
 „ *macrophylla* (*Abies*)
 „ *pendula* (*Abies, Picea*)
 „ *variegata* (*Abies*)
Caroliniana (*Picea*)
Mertensiana (*Abies Albertiana*)
Pattoniana (*Abies Hookeriana, A. Pattoniana*)

WELLINGTONIA

- gigantea* = *Sequoia gigantea*

WIDDINGTONIA

- cupressoides* (*Callitris*)
glauca (*Chamaecyparis*)

Amongst the vast number of specimens exhibited at the Conference there were some to the names of which the exhibitors added a query (?), as if being themselves doubtful as to their correctness; others, again, had no name attached—the exhibitor probably being desirous of obtaining the right one; while others, again, had a name attached which on examination proved to be wrong. Dr. M. T. Masters, F.R.S., very kindly went carefully over all the specimens with a view to confirming, adding, or rectifying the names, with the following result:—

HER MAJESTY THE QUEEN, Balmoral.

No. 2, exhibited as *Picea Alecockiana* = *P. ajanensis*. No. 7B, exhibited as *Abies firma bifida* = *A. pectinata*.

The DUKE OF BUCCLEUCH, Drumlanrig.

No. 11, specimen exhibited = *Cupressus Lawsoniana*.

The DUKE OF BUCCLEUCH, Dalkeith Palace.

No. 2, exhibited as *Juniperus occidentalis* = *J. communis*. Specimen exhibited as *Abies concolor* = *A. magnifica*.

The DUKE OF SUTHERLAND, Dunrobin Castle.

No. 3, exhibited as *Picea Engelmannii* = *P. pungens*. No. 10, exhibited as *Abies grandis* = *A. magnifica*. No. 14, exhibited as *Abies lasiocarpa* = *A. Lowiana*.

The MARQUIS OF NORTHAMPTON, Torloisk.

Specimen exhibited as *Cupressus MacNabiana* = *Thuya gigantea*.

The EARL OF ABERDEEN, Haddo House.

No. 1, exhibited as *Picea Alcockiana* = *P. ajanensis*. No. 2, exhibited as *Picea Engelmannii* = *P. pungens*. No. 3, exhibited as *Picea Engelmannii glauca* = *P. pungens glauca*. No. 14 and 18 = *Abies Lowiana*. No. 20 = *Pinus Banksiana*. A specimen exhibited as *Abies grandis* = *A. amabilis*. A specimen exhibited as *A. amabilis* = *A. magnifica*.

The EARL OF MANSFIELD, Scone Palace.

No. 3, exhibited as *Picea Engelmannii* = *P. pungens*. No. 77 = *Picea excelsa* var.

The EARL OF STAIR, Castle Kennedy.

No. 71 = *Cupressus Lawsoniana*. No. 82 and 83 = *Thuya gigantea*.

The COUNTESS OF SEAFIELD, Cullen House.

No. 4 = *Cupressus macrocarpa*. No. 27 = *Thuya gigantea*. No. 37 = *Cupressus Lawsoniana* var. No. 42 = *Juniperus communis*. No. 57 = *Tsuga Pattoniana*.

Sir JAMES H. GIBSON CRAIG, Bart., Riccarton.

No. 4 = *Athrotaxis selaginoides* (*A. Gunniana*). No. 10, 28, 30, and 31 = *Juniperus* spp. No. 29 = *Taxus baccata adpressa*.

Sir PATRICK KEITH MURRAY, Bart., Ochtertyre.

No. 77, exhibited as *Cupressus MacNabiana* = *Thuya gigantea*. No. 79, exhibited as *Cupressus thyoides* = *Juniperus* sp. No. 104 = *Pinus muricata* (*P. Murrayana*).

Sir R. JARDINE, Bart., Castlemilk.

Specimen exhibited as *Picea Alcockiana* = *P. ajanensis*. No. 1 = *Cupressus Lawsoniana*. No. 3 = *Cedrus Deodara*.

Sir R. MENZIES, Bart., Castle Menzies.

No. 11, exhibited as *Pinus Parryana* = *Tsuga Pattoniana*. No. 18, exhibited as *Pinus muricata* = *P. contorta*. No. 19, exhibited as *Pinus Jeffreyi* = *P. ponderosa*.

The Hon. H. H. DUNCAN, Fordell.

No. 3, exhibited as *Cupressus Lawsoniana* = *C. macrocarpa*. No. 8, exhibited as *Abies lasiocarpa* = *A. Lowiana*. No. 28, exhibited as *Cupressus Lawsoniana* = *C. obtusa*. No. 29, exhibited as *Cupressus Lawsoniana* = *Juniperus* sp. No. 43, exhibited without name = *Juniperus* sp. No. 48, exhibited as *Thuya gigantea* = *Libocedrus decurrens*. No. 61, exhibited as *Thuya Lobbii* = *Cupressus* (*Retinospora*) *pisifera*.

W. STEUART FOTHERINGHAM, Esq., Murthly Castle.

No. 37 = *Cupressus obtusa*. No. 66 = *Juniperus* sp. Specimen exhibited as *Pseudotsuga andina* = *Cephalotaxus pedunculata fastigiata*.

C. J. LUCAS, Esq., Warnham Court.

Specimen exhibited as *Picea Engelmannii* = *P. pungens*

W. H. MAXWELL, Esq., Munches.

No. 15, exhibited as *Abies Webbiana* = *A. bracteata*. No. 37, exhibited as *Pinus pyrenaica* = *Abies grandis*. No. 65, exhibited as *Thuya magnifica* = *T. gigantea*.

J. ORD MACKENZIE, Esq., Dolphinton.

No. 12, exhibited as *Thuya gigantea* = *Libocedrus decurrens*. No. 13, exhibited as *Thuopsis borealis* = *Cupressus Lawsoniana*. No. 19 and 28, exhibited as *Picea Engelmannii* = *P. pungens*. No. 20, exhibited without name = *Tsuga Pattoniana*. No. 21, exhibited as *Picea jessoensis* = *P. ajanensis*. No. 22, exhibited as *Picea obovata* = *P. sitchensis*. No. 42, exhibited as *Abies abchasica* = *A. cephalonica*.

W. H. NICHOLSON, Esq., Basing Park.

Specimen exhibited as *Cupressus pendula* = *Thuya orientalis*.

Messrs. DICKSONS, Chester.

Specimens exhibited as *Picea Alcockiana* = *P. ajanensis*.

INDEX.

Generic names are printed in small capitals (as *ABIES*); specific and varietal names in *italics*.

- ABIES ajanensis*, 26
Albertiana, 78, 116
Alcockiana, 27
amabilis, 68
brachyphylla, 20, 25
bracteata, 23, 68
canadensis, 117
cephalonica, 68, 79
concolor, 79
Douglasii, 80, 117
excelsa (Norway Spruce), 49, 63
firma, 24
grandis, 68, 82
lasiocarpa, 68
List of, 188
Louiana (*Parsoniana*), 9
magnifica, 83
Mariesii, 25
Menziesii, 84, 117
Morinda, 68, 85, 118
nobilis, 88
Nordmanniana, 17, 50, 86
orientalis, 118
pectinata (Silver Fir), 44, 69
Pinsapo, 68
polita, 26
sachalinensis, 20
Tsuga = *Tsuga Sieboldii*, 27
Veitchii, 20, 25
- ACTINOSTROBUS pyramidalis*, 196, 265
African Cedar, 50
AGATHIS, List of, 196
Antiquity of Conifers, 2
ARAUCARIA Cunninghamii, 337
excelsa, 338
imbricata, 62, 87, 118, 340
List of, 197
Arbovitæ, Giant, 48
ATHROTAXIS, List of, 198, 310
Awards for Conifers, 575
Bibliography of Coniferae, 179
BIOTA orientalis, 276
CALLITRIS, List of, 199
quadrivalvis, 262
CEDRUS atlantica, 50, 69, 88, 118
Deodara, 63, 69, 88, 118, 402
" *robusta*, 37
Libani, 63, 69, 406
" *argentea*, 63
List of, 200, 401
CEPHALOTAXUS Fortunei, 33, 317
List of, 201, 316
Chafer-grubs, 189
CHAMÆCYPARIS, List of, 202, 278
sphaerolæa, 38, 281
Collectors or Introducers of Conifers—
Compton, Bishop, 14
Douglas, David, 14, 74
Evelyn, John, 14
Fortune, Robert, 15, 75
Hartweg, Theodor, 14
Jeffrey, John, 74
Lobb, William, 15, 74
Maries, Charles, 15, 20
Collectors or Introducers of Conifers—*cont.*
Menzies, A., 14
Murray, William, 15
Veitch, John Gould, 15, 75
Coniferae of Japan, 18
Conifers as Forest Trees, 78
" at Dropmore, 61
" at Orton Longueville, 67
" Decorative Character of, 52
" Diseases of, 124
" Early Planters of, 76
" exhibited at the Conference, 579
" for Chalky Districts, 37
" " Economic Planting, 41
" " Parks, 35
" " Rockwork, 40
" " the Seaside, 39
" " Various Purposes, 572
" " Wet Grounds, 38
" Insects Injurious to, 150
" Small Growing, for Lawns, 36
Corsican Pine (*P. Laricio*), 45
CRYPTOMERIA japonica, 15, 30, 88, 119, 203, 300
CUNNINGHAMIA sinensis, 203
CUPRESSUS Cashmeriana, 284
Juncebris, 284
Goveniana, 284
guadalupensis, 284
Knighiana, 285
Lambertiana, 50, 119
Laesontiana, 51, 70, 89, 119, 278
List of, 203
Iustanica, 285
MacNabiana, 286
macrocarpa, 70, 90, 119, 286
nootkatensis (*nutkaensis*), 91
sempervirens, 287
torulosa, 287
Cypress, Deciduous, 70
Cypresses, Curiosities of, 9
DACRYDIUM, List of, 209
David, Abbé, 17
Delavay, Abbé, 17
Diseases of Firs, 136
" " Junipers, 146
" " Larches, 142
" " Pines, 127
Douglas Fir, 46, 80
Dropmore, Conifers at, 61
Economic Value of Conifers, 16
Epinasty, 8
Exhibitors, List of, 575
Fir, Douglas, 46, 80
" Grecian, 68, 79
" Prince Albert's, 78
" Silver, 44
Firs, Diseases of, 136
FITZROYA patagonica, 210, 266
Form and Colour of Conifers, 10
FRAXELA, 263
Fungi, Injurious, 131
Genealogy of Conifers, 3
Giant Arbovitæ, 48

- GINKGO *biloba* (*Salisburia adiantifolia*), 34,
 70, 210, 319
 GLYPTOSTROBUS *heterophyllus*, 211, 305
 Growth of Conifers, 3
 Henry, Dr., 17
 Hyponasty, 8
 Indian Spruce, 68
 Introduction of Conifers to Cultivation, 13
 Junipers, Diseases of, 146
 JUNIPERUS *Bermudiana*, 289
 caniflorica, 290
 chinensis, 33, 290
 communis, 290
 drupacea, 293
 excelsa, 293
 flaccida, 293
 foetidissima, 293
 List of, 211, 290
 macrocarpa, 294
 nana, 294
 occidentalis, 295
 rigida, 33
 virginiana, 298
 Kämpfer, 19
 KETTLERIA, List of, 216
 Lambert's Cypress, 50
 Larch, 42
 " Bug, 170
 " Diseases of the, 142
 " Miner, 165
 Largest Specimens, 568
 LARIX *americana*, 39, 413
 dahurica, 413
 europaea, 42, 414
 Griffithii, 416
 kurilensis, 416
 leptolepis, 23, 27, 417
 List of, 216, 412
 occidentalis, 417
 sibirica, 418
 Lawson's Cypress, 51
 LIBODENDRUS *chilensis*, 267
 decurrens, 69, 119, 268
 Dontiana, 268
 List of, 218
 tetragona, 269
 Maidenhair Tree, 34, 70
 Mammoth Tree, 51, 67, 76
 MICROCACHETS *tetragona*, 219
 Mount Atlas Cedar, 50
 Movements of Conifers, 5
 Murray, Andrew, 15
 " William, 15
 Nomenclature of Conifers, 11
 Orton Longueville, Conifers at, 67
 PHYLLOCLADUS, 219
 Physiology of Conifers, 5
 PINUS *grandis*, 119
 lancocarpa, 119
 List of, 220, 419
 nobilis, 120
 Nordmanniana, 120
 Pinapo, 120
 pungens, 9
 Pine, Austrian, 49
 " Beetle, 167
 " Cluster or Maritime, 49
 " Sawfly, 163
 " Scotch, 48
 " shoot Moths, 165
 " Weevil, 160
 " Weymouth, 47
 Pines, Diseases of, 127
 PINUS *austriaca*, 49, 69, 92, 120
 Cembra, 92, 120
 resinosa, 38
 resinosa, 23, 26
 maritima, 69, 92, 120
 PINUS—cont.
 halepensis, 39
 insignis, 64, 92
 Jeffreyi, 69, 94, 120
 koraiensis, 28, 366
 Laricio (Corsican Pine), 45, 64, 69, 95, 121
 368
 List of, 224, 344
 longifolia, 372
 macrocarpa, 61, 69, 95
 maritima, 95, 121, 372
 parviflora, 28
 Pinaster, 39, 96
 Pinus, 39
 ponderosa, 69, 96, 121
 pyrenaica, 96, 121
 rigida, 38, 51
 Sabina, 69
 Strobus, 47, 97
 Thunbergii, 28
 Pissodes, 163
 PODOCARPUS, List of, 242
 macrophylla, 20
 Prince Albert's Fir, 78
 PRUMNOPITYS *elegans*, 244
 PSEUDOLARIX *Fortunei*, 411
 Kämpferii, 8, 244
 PSEUDOTSUGA *Douglasii*, 46, 62, 245
 Redwood, 50, 70, 121
 RETINOSPORA, 4, 31, 245
 SALISBURIA, 320
 Savin, 297
 SAXEGOTHEA *conspicua*, 246
 SCLADOPITYS *verticillata*, 29, 246, 343
 SEQUOIA *gigantea*, 15, 37, 74, 96, 122, 247, 306
 sempervirens, 51, 97, 121, 247, 309
 Siebold, 19
 Silver Fir, 44
 Snake Firs, 9
 Spruce-gall Aphid, 170
 " Hemlock, 79
 " Indian, 68, 85
 " Norway, 49
 Stature of Conifers, 11
 Tallest Specimens, 568
 TAXODIUM *distichum*, 70, 248, 302
 mucronatum, 248
 sempervirens, 70
 TAXUS *fastigiata*, 70
 List of, 248, 312
 TETRACLINUS *articulata*, 250
 Thunberg, 19
 THUYA *gigantea* (Lobbi), 9, 15, 71, 97, 270
 japonica Standishii, 20, 274
 List of, 250
 occidentalis, 9, 272
 phacata, 71, 274
 Whipcord, 71
 Thuyas, Curiosities of, 9
 THUYOPSIS *borealis*, 9, 91
 dalabrata, 275
 List of, 253
 TORREY *drupacea* (= *Cephalotaxus*), 33
 List of, 254, 317
 Myristica (= *T. californica*), 70
 TSUGA *canadensis*, 39
 List of, 254, 441
 Utility of Conifers, 11
 WELLINGTONIA *gigantea*, 15, 37, 74, 98, 122, 247,
 306
 Weymouth Pine, 47
 WIDDINGTONIA, 256
 cupressoides, 265
 Wireworms, 158
 Woodwasps, 176
 Yew, common, 70
 " foetid, 70
 " Irish, 70

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